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VIEWS, NEWS AND INTERVIEWS

"People in the engine business will, doubtless, recollect Miles Greenwood, of Cincinnati," said a resident of that city. "He was prominent for years as a foundryman and engine builder, and did much toward developing the modern fire engine. Miles Greenwood's father was an eccentric character, who, in his later life, became exceedingly pessimistic in his views of the world in general. A few years before he died the old gentleman joined the communistic colony at New Harmony, Ind. He tired of the scheme after a while and expressed a wish to die. So he procured a long, iron rod, which he carried pointed toward the heavens whenever there was a thunder-storm. He would parade around the grounds of the colony with his upraised rod praying and hoping to be struck by lightning, but such was not to be his fate. He died of old age in a comfortable bed."

The Cincinnati, Ohio, Street Railway Company is now operating about 700 cars.

The newly formed Labor Party has adopted as one of the planks in its platform, municipal ownership of telephones and other public utilities.

It is reported that the Amalgamated Copper Company recently offered $1,000 a share for a controlling interest in the Calumet & Hecla copper mines. The offer was promptly declined.

In the High Court of Justice at London on August 30 the Mercantile Publishing Company applied for an order to expunge the name of the International Cable Directory Company, of New York, from the books of the Stationers' Company as the owners of the Western Union Telegraph Code and International Cable Directory, on the ground of infringement of their code. The motion stood over until October, the defendants agreeing to submit to English jurisdiction.

The proprietors of the electric light station at Iquique, Chili, have been compelled to shut down the plant three times in four years, owing to difficulty in getting the city to pay its bills for street lighting. There are 120 arc lamps in the streets and about 2,500 16-candle-power incandescent lamps are connected with the station which is equipped with Thomson-Houston apparatus.

The New Zealand Government has agreed to contribute to the laying of a trans-Pacific cable.

The leading issue in the campaign for municipal offices now going on at Nashville, Tenn., is the question of municipal ownership of public utilities. Mr. J. M. Head, member of the National Democratic Committee, is candidate for mayor, and advocates the purchase of the street railways, gas and electric plants and waterworks system, while Mr. Kinney, his opponent, is against municipalization. Newspaper support is divided.

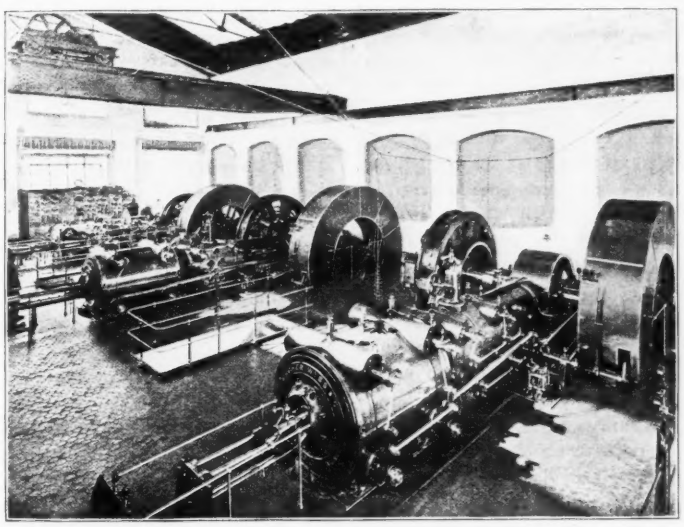
A preliminary appropriation of $5,000 has been made by the state of New York for the Pan-American Exposition to be held in Buffalo in 1901.

Electric lights will be so abundant, they say, during the Dewey reception that the nights will be as bright as day; but then, a dewy night is always bright.—*Brooklyn, N. Y., Citizen.*

The Commercial Cable Company announces that the Japanese land lines are interrupted beyond Shimonoseki. There will be delay on messages for Yokohama, Tokio, Hiogo, etc., by all routes.

Mr. J. H. Balch, of Greenwich, N. Y., electrical engineer for the San Domingo Improvement Company, of New York city, arrived in the United States last week for a brief vacation.

One can learn a good deal from the daily newspapers. It was stated the other day, by a correspondent of one of them, that the Town Council of Elroy, Wis., has hit upon a great scheme for cheapening light. He says: "The City Council has fixed by an ordinance the cost of electric lights at 10 cents per 1,000 volts. This will amount to half a cent per hour for one 16-candle-power and will be much cheaper than oil. Meters will be furnished by the city. Many orders have already been taken, and it is believed that the system will be placed on a paying basis as soon as the current is turned on. The station is also being built."



THE ENGINE-ROOM OF THE FLORENTINE TRAMWAY COMPANY, AT FLORENCE, ITALY.

THE ELECTRIC TRAMWAYS OF FLORENCE, ITALY.*

A FINE INSTALLATION IN ONE OF THE MOST BEAUTIFUL OF EUROPEAN CITIES.

Among the important systems of electric tramways that have been developed in a number of Continental cities, none is likely to attract more attention than that at Florence. The mere mention of the city fills the mind with a host of associations to most of which, it must be confessed, the idea of modern tramways is wholly foreign, if not utterly incongruous. One can not help wondering what reception such projects as have now been carried out would have received at the hands of either Guelphs or Ghibellines in the old days when the isolation of the city was so strenuously maintained. As for transport to outlying towns, could any citizen have been found so demented as to suggest it? No, indeed, let the gates be shut and barred with the happy mortals, for the time being, in possession of the city to defend them, and let no miserable *fuori-usciti*—the turned out—have the effrontery to parley about the advantages of interurban communication. Florentines, in their city of flowers, with their ardent political contests, their wonderful pictures, and their beloved Arno, wanted nothing better than a holiday within the walls and the knowledge that the exiles were futilely plotting without. But it is a far cry to the thirteenth century, and although Florence delayed long in putting on a modern aspect, it is now as keen in pursuit of prosaic improvements as it was in the old days to achieve architectural magnificence. So it need not surprise the visitor to alight from a trolley car in front of the white walls of the Duomo and Giotto's unrivaled Campanile; for in Florence, as in Milan, one may almost step from the cars to the cathedral doors. This sounds destructive of accepted tradition, but the effect is really less startling than might be supposed; for the trolley wires are suspended from span wires fixed to the building by rosettes, and do not

*From the (London) *Railway World.*

seriously mar the appearance of the cathedral squares or adjacent streets, although were it not for the great convenience they afford one might wish the wires elsewhere. But there is little doubt that one of the reasons for the ever growing popularity of the city as a resort is the excellent service given by the electric cars. Situated in the midst of a picturesque and undulating country, and surrounded by populous towns, such as Fiesole and Sesto, the city has all the conditions that make rapid and pleasurable traveling facilities so desirable and necessary, as well as profitable.

Speaking generally, the present system of tramways may be said to consist of three principal lines, all of which start from the Duomo, at the center of the city, and radiate toward the suburbs, subdividing into seven lines. A circular route constructed along the fine boulevards, which surround the city, completes the system and unites all the other lines. The whole system comprises 37.5 miles, throughout the greater part of which severe gradients and sharp curves are numerous. One of the lines, that which connects Florence and Fiesole, reaches the latter by an uninterrupted series of gradients which bring the cars to an altitude of 990 feet, or about 825 feet above Florence. The track, for a length of 2,409 feet, doubles on itself by a series of curves and counter curves, some of which have very short radii. This line has been worked electrically since 1891, when not a single trolley line was working in the United Kingdom, and it has afforded a very thorough test of the apparatus in use, which is of the Thomson–Houston type. The results obtained from the pioneer line so convinced the Florentine Tramways Company of the capabilities of electric traction that in 1897 they sought and obtained powers for adopting the trolley system on their other lines.

The new generating station has been constructed upon a large site situated upon the circular line at its junction with the line to Fiesole. The boiler-room contains four steam generators of the Weinlig type, with two cylinders superposed. Each boiler has a heating surface of 1,668 square feet, and is capable of producing 5,511 pounds to 6,613 pounds of dry steam per hour, at a pressure of 135 pounds. The heated gases, before escaping through the chimney, 150 feet in height, pass through a Green's economizer of the usual pattern. Feed-water, after having passed through a purifier, is delivered to a tank, from which it is drawn by two pumps, which force it through the tubes of the economizer and from these to the boilers.

The engine-room is placed beside the boiler-room, from which it is divided by a party wall, and contains three tandem compound horizontal engines, which can be worked either condensing or with a free exhaust. These engines are direct-coupled to the generators. Two of the engines have a capacity of 700 indicated horse-power, at a speed of 120 revolutions per minute and a pressure of 120 pounds. The third machine runs at the same speed, but it is only of 350 indicated horse-power. The air-pumps for the condensers are connected to a prolongation of the pistons. The service of the condenser water is effected by an electric motor of 25 horse-power, which drives a centrifugal pump. This takes the water from the condensers and sends it through a cooler erected in the station grounds, whence it is returned to the basin of the air pumps of the condensers.

The two large engines each drive an eight-pole Thomson–Houston generator, type M. P., with a capacity of 425 kilowatts at 500–550 volts. The 350-horse-power engine is coupled to a generator of the same type with six poles, and has a capacity of 225 kilowatts at the same voltage. All the cables which connect the dynamos to the switchboard are carefully insulated, and are taken through a large subterranean gallery, well lighted and ventilated.

The safety fuses, with magnetic blow-outs, with which each pole of the dynamo is provided, are mounted on a special switchboard placed in the basement. The main switchboard is placed at one extremity of the engine-room, and consists of eight panels, of which three are for generators, one for the station indicators, one for the station lighting and motors, two for the two feeders and one spare panel.

Adjacent to the station is the repair shop, the machines of which are driven by a 20-horse-power electric motor.

The overhead work, both in the city and in the suburbs, consists of a double trolley wire, .325 inch in diameter. The suspension of this double wire is effected in the center of the city from cross-wires suspended from metallic poles or from rosettes affixed to the walls of the houses. In some cases the wires are suspended from poles with side brackets. The overhead system is divided into sections of about one-fourth mile in length, each being provided with a lightning arrester and cutout, which are placed in such a manner that one of the two parallel wires of the same section can be, in case of accident, cut out of the circuit, service being continued by the second trolley wire. The overhead wire is placed at a height of about 21 feet above the level of the rails, as prescribed by the regulations.

In one particular the overhead work at Florence is specially noticeable; viz., in the comparative absence of guard wires. In most English cities the necessity for stringing these over the trolley lines has added very much to the unpleasant effect of the overhead work, the guard wires in some cases forming a much greater obstruction to the view than the trolley wires and their supports. In Florence the tramway company has had the good fortune to find in the management of the telephone service every disposition to cooperate with them in reducing the necessity for guard wires, and the two companies have made arrangements by which the telephone lines have, wherever possible, been put under ground. The result is that the number of guard wires has been reduced to a minimum, and the overhead line gains very much in appearance. The Administration of Telephones has, moreover, placed fuses on all their apparatus at the central station and on those of their subscribers.

The feeders are laid underground only in the center of the city. They consist of insulated and armored cables, and they are connected to the overhead line at the feeder points through the poles. On the suburban lines the feeders are entirely overhead. The return circuit is formed by the rails in the usual manner, bonds of the Chicago type being used, and the rails are cross-bonded at intervals of about 150 feet by a copper wire 5/8 inch in diameter. The return feeders consist of old rails weighing 66 pounds per yard, electrically connected and buried at a depth of about 24 inches. They are connected at suitable points to a metallic circuit formed by the track rails and to the negative pole of the generators.

In the center of the city the track is laid with grooved girder rails weighing 75 pounds per yard and 30 feet in length. These rails are placed upon metallic cross-sleepers weighing about 41 pounds each. The sleepers are so placed that there are seven beneath each of the thirty-foot rails.

In the suburbs Vignole rails have been used, weighing about 52 pounds per yard, placed upon wooden sleepers, each rail being 29 feet 6 inches in length, and resting upon 10 sleepers.

On the whole system 75 motor carriages are employed. Sixty of these are of the closed type, and are equipped with two G E–800 motors of 25 horse-power each. There are also 10 open carriages equipped with two G E–800 motors, and five closed cars with two G E–57 motors of 50 horse-power each. The last-named are designed to haul into the city trains which are drawn to the barriers by steam locomotives upon lines to which electricity has not yet been applied. All these carriages are provided with Thomson–Houston parallel controllers (type BA) and electro-magnetic brakes. The carriages all have a capacity for 38 passengers, and they are mounted upon Brill 21 E trucks, which take the sharp curves with the greatest facility, although the wheel base is six feet. The Tramways Company have besides a number of trail cars, which are used on holidays when the traffic is unusually great. The trial cars also have magnetic brakes, like the motor cars.

The French Thomson–Houston Company, of Paris, carried out the electrical equipment of the tramways, but the boilers and engines were supplied by Escher–Wyss et Cie, while the permanent way and buildings were constructed by the Florentine Tramways Company itself. The installation and service have given complete satisfaction, not only to the public, but to the company, which report that a very considerable increase in traffic and receipts is noticeable, while at the same time the expenses have very much decreased. Thus it has happened at Florence, as in other cities where animal traction has been superseded by electric motors, that from the first day on which the lines were opened the traffic has exceeded the estimates, and the number of cars at first provided has been found insufficient. It is anticipated that the Tramways Company will very shortly require further additions to its rolling stock. As may be easily understood by those who have had the good fortune to see Florence, some of the suburban routes present most attractive views, and it is not surprising that the cars are largely made use of by the public as a means of recreation. It is to be wished that the tramway authorities about London would take example from the way Florence has dealt with the tramway question, and would themselves provide tramway facilities, or allow promoters to construct lines into the suburbs. Such a scheme as that proposed, for instance, for tramways to Hampton Court would, without doubt, demonstrate again the convenience and pleasure which the public derive from such undertakings.

The Liquid Interrupter for Starting Single-Phase Induction Motors.

A new and highly practical use for the liquid interrupter of either the Caldwell or Wehnelt type has just been described in the Italian journal, *L'Elettricista*, by Signori Guido Grassi and Ferdinando Lori. The illustration shows in diagram the method adopted. It is well known that if an interrupter of this character is connected in circuit with an alternating current it will produce a sort of rectifying effect, while at the same time the interrupting action of the apparatus will take place and impress itself upon the alternating wave. If a circuit is built up in the method shown in the figure, in which AB and BC are equal inductive resistances in series with one another, and a liquid interrupter is shunted around one of them, then when an alternating current of sufficient energy (enough to cause a fall of effective potential of at least 40 volts from B to C) is sent through from A to C, the current in the two coils can be the same only at the instant when the interrupter has a practically infinite resistance. The resistance of the interrupter varies, according to a definite law, from practically nothing to very high values. When it acts as a very high resistance, the current in the two coils is the same, and the magnetic effects due to them are naturally the same. When the interrupter falls in resistance it becomes an effective shunt around the coil BC, decreasing the current in that and correspondingly increasing both the total current through the apparatus and that in the coil AB. Now, if these two coils are so arranged that their magnetic axes are at right angles, then the resultant magnetic field, due to both, is constantly varying in direction with a periodic fluctuation equal to the period of the interruption. By the law of continuity, during the change of direction of the magnetic lines, there is an effective rotation of the vector representing them; in other words, the conditions are those of the rotating magnetic field. If the two coils are the two field windings of a single-phase induction motor, the rotor will be acted upon by this rotating field and will experience a torque, even if it is standing still. If the intensity of this effort is sufficient the motor will start.

The experiments of the authors were conducted upon a Brown-Boveri motor of 20 horse-power. The interrupter was of the Wehnelt form, and consisted of a vessel containing a saturated solution of carbonate of soda, in which one electrode was formed of a large lead plate and the other of a bundle of ⅜-inch electric light carbons. By regulating the number and the depth of immersion of these in the solution the frequency of the interruption could be varied at will. The motor is said to have started with large torque, moving off under the load of heavy machinery belted to it, and consuming no more current than when started by the ordinary method of choking coils and resistances. It is the opinion of the authors that they have discovered a valuable contribution to the solution of the interesting industrial problem involved in the design of simple and satisfactory apparatus for starting motors of this type. They conclude their paper with this statement: "The day in which a starting apparatus for non-synchronous, single-phase motors is brought out will see the longest step taken toward the application of these machines to traction purposes."

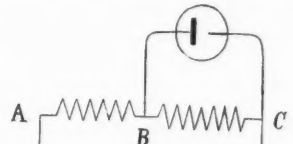


DIAGRAM OF METHOD OF STARTING INDUCTION MOTORS.

Expensive Conversation.

It is stated that last week a conversation was held over the long-distance telephone between Brooklyn, N. Y., and St. Louis, Mo., which cost the parties to it about $3,000. The rate for conversation over this line, during the night hours, is $5 for five minutes and $1 a minute for additional time. Most of the talking was done at night and the bill for one continuous conversation amounted to $716. This shows that the talk lapped over into the high-priced day hours, as one might converse steadily from eight o'clock in the evening until six o'clock in the morning for only $600. It is said that neither of the parties to the conversation was a woman and it is not known which had the last word.

A decision is expected from the United States Circuit Court of Appeals at Boston, on November 7, regarding the alleged infringement of the American Bell Telephone Company's Berliner patent by the National Telephone Company and the Century Telephone Company.

American Workshops in England.

One of the causes of the widespread prosperity that this country is now enjoying, is unquestionably the industrial deadlock in Great Britain, which has curtailed the production of that country to an enormous extent, and gone far to remove it from the field of active competition. The English view of the situation is so well set forth in a leader in our London namesake that it is reprinted here in full:

It will be a matter of great interest to watch the developments of American enterprise in establishing workshops in England. If the Westinghouse company at their new works are likely to employ 5,000 men as anticipated, the question arises, Where are these men to come from? If skilled men are wanted they will have to be drawn by superior inducements from other employment. These being obtained, and working, we may suppose, equal hours with men in other shops—they will hardly be allowed to work shorter hours by an American management, accustomed to the long hours of America—will there be any trouble with the trades unions when the American method of multiple tools is, as it will be, insisted upon? Will the now discredited Amalgamated Society of Engineers make a fight over the employment of floor laborers to attend to automatic machine tools? We feel much inclined to welcome the American company in establishing its works in England. English wages are not much less than American, in many cases they are higher. Per unit of output under the paralyzing influences which have crippled English practice, the wages cost is distinctly higher all round. Assuming that the American company can effect no good with its workers, it will be a very simple matter to charter a large steamer and land 1,000 men at once from New York at the works on the Ship Canal at Manchester. There are plenty of workmen in America who would, if required, make the change. They might not at first like the change, for an American is intensely conservative in his habits of life, and does not mind sleeping in a windowless cell if he can only get green corn to eat. But he would in time find that, climatically and otherwise he was better off here than at home. Bar the lack of transit facilities, England is a pleasanter country to live in than America. We may take it that a sufficient force of American workmen could be permanently maintained at the new works. In receipt of good wages and well housed no outcry could be raised against them, and they would be safe from outrage in a way they would not be in America. We should then have the spectacle of the new works underselling most competitors, simply because of its cheap output. This could scarcely go on: the closing of works unable to compete would follow. It might be necessary to do this before the trades unions recognized the folly of opposing new methods any longer. The new works would, however, be a center of influence, from which surely better ideas would radiate. Secure against the tyranny of a work's stores, too common in America, by the protection of our Truck Act, and generally under the protection of English law, we do not see that the American works could become an evil. The methods of the Carnegie company would be impossible, and Pinkerton men to shoot at sight could not be employed. On the whole, therefore, a healthy competitive influence may be anticipated. It must strike the more thoughtful of trade unionists that one consequence of their efforts to defeat modern methods of production should have been the planting of a large works right in our midst to carry out such methods. While we have assumed the possibility of a struggle, we scarcely think this will arise. Those behind the scenes know that many English workshops have been enabled to make great changes since the strike of 1897, and probably the new works will simply serve as a stimulus all round and hasten the adoption of better methods. There is room for more manufacturing in England; at present it is impossible to obtain anything in decent time. Steam engines, cars, motors, boilers and all classes of engineering work can only be obtained in reasonably short period from America. It is quite time this was changed.

PERSONAL.

Col. S. G. Booker, of the Phœnix Battery Manufacturing Company, of St. Louis, was a recent visitor to New York city.

Mr. C. E. Corrigan, president of the American Electric Vehicle Company, Chicago, arrived in New York city last week.

Mr. George Bullock, president of the Bullock Electric Manufacturing Company, Cincinnati, has been enjoying a vacation at several Atlantic coast resorts.

Dr. Allan V. Garratt, chief engineer for the Lombard Water-Wheel Governor Company, of Boston, was among the out-of-town visitors to New York city last week.

Mr. Wm. G. Latta, general agent of the Pennsylvania Railroad, has tendered his resignation, which took effect September 1. It is said that Mr. Latta will assume the presidency of an electric railway company now in process of formation.

Mr. Cyrus O. Baker, Jr., the platinum refiner, of New York, has returned to the city after an enjoyable rest at the famed Olympic Club, on Long Island. A fishing contest between Mr. Baker and Mr. H. L. Shippy, of New York, off the coast of Fire Island, resulted in a great victory, in point of number and weight of fish, for whichever gentleman has the first opportunity to narrate the incident.

SCIENCE BREVITIES.

Nickel Compass Cases—It is not so generally known as it should be that nickel is a magnetic metal. When this metal is used, as it is frequently, for the cases of compasses it is liable to affect seriously their indications, says Mr. F. J. Smith in a letter to *Nature*. It has been used not only in small tourists' and pocket compasses, but also in the larger instruments for marine use.

Russian Weights and Measures—By a recent ukase a standard of Russian weights and measures has been fixed. The unit of weight is the Russian pound, equal to 409.512 grammes, a vedro or pail must hold 30 pounds of distilled water at 16⅔ degrees Celsius, while the garnietz must equal eight pounds of water. The unit of length is the arshin, equal to 71.12 centimetres. The metric system may be used by the side of this.

The Density and Dimensions of Atoms—In a contribution to *Rendiconto Lincei* Signor G. Guglielmo describes some highly interesting experiments upon the absorption of X-rays and cathode rays by various kinds of matter, undertaken with a view to deducing the dimensions, absolute weights and densities of atoms. The discussion is too long to be abstracted here, but the result reached is that the density of atoms is in the vicinity of 80,000 kilogrammes for a cubic centimetre; in other words, that it is 80,000,000 times that of water, or that atoms weigh about 28,000,000 pounds per cubic inch.

Electro-Chemical Equivalent of Silver—In a recent note to the Académie des Sciences K. Kahle discusses the management of the silver voltameter. His experimental work consisted in a determination of the ratio of the electro-motive force shown by the Clark standard cell when measured by a Helmholtz absolute electrometer and by a method involving the electro-chemical equivalent of silver. The silver deposit seems to differ in weight under differing treatment. If it is wasted in warm water in the presence of atmospheric oxygen some seems to be dissolved and the deposit shows too little weight. The deposit on clean platinum is apparently less, other circumstances being equal, than that on silvered platinum.

The author determined the electro-motive force of the Clark cell, at zero centigrade, to be 1.44955 volt. The cadmium element, at 20 degrees centigrade, gives 1.43305 volt. His average value for the electro-chemical equivalent of silver is 1.1183 milligrammes per ampere-second or coulomb.

Flexible Spark Discharges—In *Wiedemann's Annalen* Mr. E. Lecher describes some extraordinary and beautiful phenomena obtained with a Caldwell or Wehnelt interrupter and a magnetic field. He finds that the secondary current obtained with the interrupter is uni-directional, and corresponds to the break of the primary current only. Hence the secondary sparks may be employed for demonstrating the influence of a magnetic field upon a flexible conductor, a function which it fulfills with great brilliance of effect. It is well known that every spark discharge, as well as the arc, shows an upward curvature, partly, at least, due to an ascending current of heated air. If the discharge obtained with the liquid interrupter takes place between two wires slightly inclined to

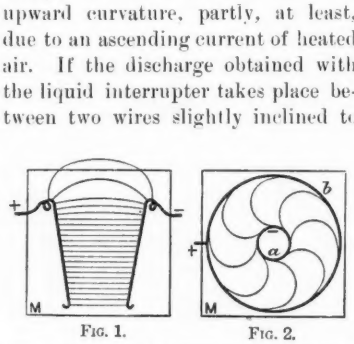


FIG. 1. FIG. 2.

APPARATUS FOR ILLUSTRATING FLEXIBLE SPARK DISCHARGES.

each other (Fig. 1), the discharge sets in at the bottom, ascends under the influence of the hot air, and finally snaps at the top, to begin again as before. But when a powerful magnetic field is created at right angles to the plane of the wires, the process is greatly accelerated, the lines of discharge succeeding each other at such a rate that they appear to form one flaming surface. On reversing the field the discharge remains at the bottom, and even curves downward unless much heat is developed. Another pretty effect is obtained by letting the discharge take place between a disk *a* and a circular wire *b*. The discharge normally goes straight up from *a* to *b*. But, on exciting the magnet, a kind of wheel is produced, having curved luminous spokes (Fig. 2), which revolve rapidly in a direction determined by the sign of the field. The spark lines are much closer together than shown in the figure taken from the *Electrician*. The author describes a number of other striking experiments, illustrating the behavior of these flexible discharge threads. They make capital lecture experiments.

Electric Lighthouses—A writer to the London *Times* claims that extended scientific examination of the matter, based upon the best opportunities of judgment, have more and more led to conclusions unfavorable to the employment of the electric arc for lighthouse purposes; that in clear weather other lighthouse illuminants are amply sufficient in power, and the electric light is very apt to mislead the navigator as to his distance from the light, whilst in hazy or foggy weather repeated observations alike by mariners and scientific men have shown the inefficiency of the new light, even of the most powerful description, in a lighthouse of the first order, though this, it is admitted, may be due in part to the fact that rays of high refrangibility, such as are emitted by the light in question, are more largely absorbed by a fog than rays of lower refrangibility that are emitted by oil or gas. Another and more potent cause is said to be in the very condition which gives the arc light its great value for optical uses; namely, its concentration in a minute area compared with oil or gas. But this is regarded as a positive disadvantage for a lighthouse illuminant in foggy weather.

Cellulose Acetate—Acetate of cellulose is a new substance that somewhat resembles nitro-cellulose, and may largely replace celluloid. It is non-explosive, however, and will stand a high temperature without decomposition. It is soluble in chloroform and nitro benzine, but not in alcohol, ether, or acetone. As an electrical insulator, acetate of cellulose has a high value, its resistance being said to be higher than that of india-rubber or gutta-percha. It has been found useful in many places where mica is now employed, and it will very likely take the place of that mineral to a considerable extent.

A Substitute for Platinum—Seeing the growth of the electric light industry and the advance that has taken place in the price of platinum, the demand for some reliable substitute for the latter metal is becoming more urgent, says *Industries and Iron*. Its value in connection with incandescent lamps, etc., is due to the fact that its coefficient of expansion is identical with that of glass. Consequently, when an incandescent lamp becomes heated both the glass and platinum expand equally and simultaneously, obviating any risk of the glass breakage or of the separation of the materials. It is now claimed that M. C. E. Guillaume, of Switzerland, and M. L. C. Dumas, a Frenchman, have discovered that an alloy of nickel and steel can be obtained to take the place of platinum in this connection. By varying the proportions of either metal an alloy results with almost any desired coefficient. When only a small proportion of nickel is employed a coefficient of expansion between that of iron and that of nickel is obtained. With 23 per cent of nickel the coefficient of expansion of brass is reached. As the proportion of nickel is then increased the coefficient of expansion progresses, until, when the nickel reaches 37 per cent. it becomes practically nil. Beyond that an increase again takes place until, with 45 per cent of nickel in the alloy, the coefficient becomes equal to that of platinum, and the result becomes of importance to the electrical industry.

A New Radio-Active Substance—By extraction from a large quantity of uranium ore, E. de Haën, of List, near Hanover, has obtained substances which possess the properties ascribed by M. and Madame Curie to "radium" in an extraordinary degree, says the *Electrician*. Two preparations have been made. Preparation A exhibits the properties of Becquerel rays. It excites fluorescence in a barium platinocyanide screen even across opaque substances, affects the photographic plate, makes air electrically conducting, and has an additional property not hitherto described, that of being itself strongly luminous. Preparation B possesses in general the same properties as preparation A, but the excitement of the screen is more intense, whereas the self-luminosity is feebler. In both cases the rays which produce fluorescence penetrate bodies like black cardboard more readily than they penetrate glass. Both preparations must be carefully preserved from moisture, especially the first preparation, which loses its own luminosity in a few hours when exposed to the moisture of the atmosphere. Once the luminosity is lost it is difficult to restore it. The only expedient which succeeds, as a rule, is that of melting the substance in the oxy-hydrogen blowpipe.

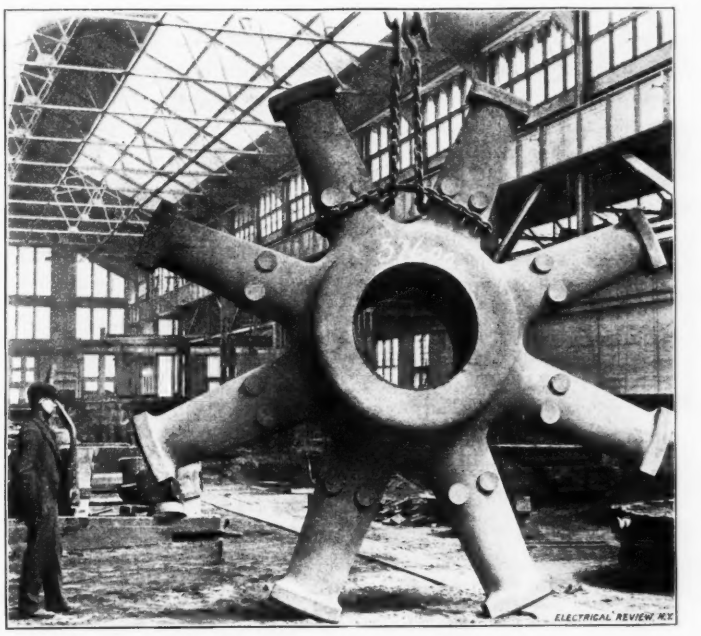
Copper—The *Mining Journal* says that owing to the development of the electrical industries in Germany, the increase in the consumption of copper and lead appears to be greater than in any other country. In 1897 the consumption of copper was 92,148 tons, and that of lead 133,239 tons, whilst in 1898 the consumption of copper was 98,160 tons, and that of lead 159,229 tons. Germany produces seven per cent of the world's supply of copper, and consumes 22½ per cent, whilst its production of lead is 17½ per cent of the world's supply, and its consumption 20 per cent.

The Trans-African Telegraph.

In the ELECTRICAL REVIEW for August 16, 1899, appeared an illustrated account of the building of the Trans-African telegraph line which forms a part of Mr. Cecil Rhodes's imperial scheme for the British control of Africa. In a recent report of the British Central Africa Protectorate it is stated that the line has now proceeded north to a point close to the south end of Lake Tanganyika, and that a branch line is now in course of construction from Domira Bay, on the west shore of Lake Nyassa, to Fort Jamieson, the headquarters of the British South Africa Chartered Company in Mpeseni's country. With regard to the extension northward of the African Trans-Continental Telegraph Company's line from the south end of Lake Tanganyika towards Uganda, it is stated by the company's representative that a steamer of considerable size has already been ordered in England for Lake Tanganyika, to be used both for the transport of telegraph material from the south end of that lake to various points on its eastern shore, and also for telegraph purposes after the construction of the line is completed. The telegraph company have now a large number of native operators, and they find that the educated African, as turned out by the various missions in the country, takes readily to telegraph work. Dr. Laws, the head of the Free Church of Scotland Mission in the Nyassa districts, has established a short line of telegraph at the Kondowe Mission, and has a special class of natives who are trained for this work. By thus using native telegraph operators it will probably be possible in future to carry on the work of the African Trans-Continental Telegraph Company's lines with only a very moderate number of European employés. From April 1, 1898, to March 31, 1899, 176½ miles of line were constructed and strained; i. e., from Kota Kota to 44 miles beyond Karonga. Blantyre is now in direct communication with London via Cape Town on the one hand, and with the most northerly part of Lake Nyassa on the other. A Belgian expedition, under the command of Mr. Mohun, passed through the protectorate in the commencement of 1899 for Tanganyika, its object being to erect a telegraph line from a point on the west shore of Lake Tanganyika to the Congo River. A German expedition also passed through with material, etc., to place a new steamer on Lake Tanganyika.

A Large Casting at the General Electric Company's Foundry.

The illustration herewith shows an immense "spider" for one of the 3,500-kilowatt generators under construction for the Metropolitan Street Railway Company, of New York, by the General Electric Company. It will be remembered that this company has the largest single building devoted to iron founding in the world, its ground plan being 140 by 743 feet. It is a notable fact that such a foundry should be required for the manufacture of electrical machinery alone.



ARMATURE SPIDER FOR A 3,500-KILOWATT GENERATOR.

On March 24 of this year, while a party of editors of the technical and engineering press were being entertained at the works, the great "spider" shown in the illustration was poured into the mould, by way of inaugurating the new foundry. This casting weighs 37,600 pounds, and is one of the largest ever made for a similar purpose.

Concerning Windmill Power for Electric Lighting.

In last week's issue of the ELECTRICAL REVIEW there appeared a letter from Dr. C. F. Brush in reply to a query concerning the use of windmills for the working of small isolated plants. Prof. Elihu Thomson, writing under date of August 29 concerning this question, says:

"I do not think it will be necessary for me to make a long statement in regard to the windmill plant. I would express it in this way: For my own part I would as lief have an engine worked by the dry leaves that fall from the trees in Autumn as to depend upon a windmill for power for lighting. I have seen the experiment tried, but I know that the success was practically *nil*. Still, there are places where the wind blows fairly steadily; there are other places where you can not tell when it is going to blow or when it is going to stop. One of these latter places is Lynn, Mass., on which I base my opinion of windmills generally. The fact is, I have no faith whatever in the practical nature of any such plant; in other words, there is too much plant and too little output.

"Mr. C. F. Brush . . . still has his windmill which was formerly used for lighting his house, but I am informed he now has connection with the city lighting plant, and uses the windmill only for experimental purposes. His windmill, as you know, is one of the largest ever constructed, the wheel, I think, being some 60 feet in diameter. Cleveland, where Mr. Brush is, is quite a windy city, as you may know."

FRENCH NOTES.

The number of electrically operated delivery wagons is constantly increasing, as they present decided advantages both as to reduction of expense as well as convenience and rapidity. Among the different types which are to be seen, those made by the firm of Ch. Milde & Company may be taken as characteristic; these wagons made a good showing in the annual competitive tests of electromobiles held recently, and which brought out the merits of the different types of automobiles now in use here. This wagon is arranged to carry a load of 1,320 pounds of merchandise and a conductor. The battery is arranged under the benches, on each side of the central passage. The framework is made of two longitudinal channel-bars united by cross-pieces. The motor is of the Postel Vinay four-pole type with series winding, giving normally 3,000 watts at 83 volts, and weighing 440 pounds. The differential, operated by the pinion of the armature, is placed on an intermediate shaft carrying a chain wheel on each end by which the hind wheels of the wagon are driven. The controller gives different speeds according to certain combinations of battery and resistances. The wagon when empty weighs 2,300 kilogrammes, and its consumption of energy varies from 75 to 90 watt hours per ton-kilometre. The great stores of the Louvre have now fine delivery wagons in service; these have been made by the Jenatzy Company, and, like the former, have the motor mounted upon an intermediate shaft. The Columbia Company have furnished a wagon of American make to the daily newspaper, *Le Matin*, and have received orders for a number of others of the same type.

The series of tests of electromobiles which has lately been organized by the journal *Le Sport Universel* has been a decided success. This is the first of this kind in which electromobiles have taken part exclusively. As the vehicles were of well known makes, the results are of value and have a direct practical bearing. The tests included; first, a time-test over a route of 52 kilometres which had been previously laid out over the different streets and roads in the suburbs; second, a duration test on the track at Longchamps. The table shows the result of the time-test.

TABLE FOR TIME TEST.

	Vehicles.	No. of Places.	Weight Kg.	Time.
1	Columbia.....	2	995	1h. 39m. 10s.
2	Bouquet, Garcin et Schiore.....	2	990	1h. 48m. 10s.
3	Columbia.....	1	670	1h. 53m. 13s.
4	B. G. & S	2	970	1h. 54m. 23s.
5	Columbia.....	1	1,480	2h. 18m. 39s.
6	Columbia.....	2	1,140	2h. 23m 3s.
7	Columbia.....	2	1,125	2h. 26m. 46s.
8	B. G. & S.....	3	1,180	2h. 38m. 44s.
9	Créauche.....	2	670	3h. 6m. 22s.
10	Mildé.....	Delivery wagon	2,200	3h. 25m.

It will be interesting to note that the Columbia vehicle, of American make, takes the first place, with an average speed of 39 kilometres per hour. In the second test only five competitors were entered, these being Nos. 2, 6, 7, 8 and 9 of the above table. The vehicle of the make Bouquet, Garcin & Schiore, No. 8, held out the longest and made 76 kilometres before the batteries were exhausted; this distance, added to the 52 kilometres already run, makes a total of 128 kilometres (80 miles) without recharging the batteries, and speaks well for the capacity of the accumulators and efficiency of the motors. C. DE K.

Paris, Aug. 24, 1899.

Electrical Review

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News, Subscriptions and Advertisements.

SPECIAL NOTICE TO ADVERTISERS.

CHANGES for advertisements must be in this office by Friday noon for the following week's issue. NEW ADVERTISEMENTS should be in the office not later than Saturday noon to insure publication the following week, although it is occasionally possible to get in matter received on Monday.

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SELF-GENERATING POWER.

The Liquid Air Power and Automobile Company, Edwin Planta, of Boston, president, having offices in Boston, capitalized at $5,000,000, advertises in a New York newspaper that it will sell certain shares of its stock at $3.00 per share.

It is stated that Messrs. Hans Knudsen, George Code and Milton Chase are the inventors of the processes of preparation and utilization of liquid air which this company controls, and, to quote the advertisement:

"Not only have these men devised the means of controlling the power of liquid air to the use of man, but through their ingenuity have been devised the means of more than doubling its effectiveness, for they have made possible the production of *five horse-power from two without additional cost.*"

It is needless to say that five horse-power can not possibly be produced from two. There is some gold in sea-water; there is no mine of perpetual power in liquid air.

THE CONVENTION MONTH.

September has apparently become the month of conventions, of gatherings of the electrical fraternity and their brethren of the allied professions and industries for mutual enjoyment and profit. These conventions are distinctly American institutions, though they are beginning to have an increasing vogue on the other side.

The meeting of the National Association of Municipal Electricians, at Wilmington, Del., has just been held, an account of it appearing in another column of this issue. Next week two associations meet—the New York State Street Railway Association, which holds its convention Tuesday and Wednesday next, at Ithaca, and the Old-Time Telegraphers' Association and United States Military Telegraph Corps, who meet at the Copley Square Hotel, in Boston, on the same days.

On Thursday, September 14, the National Export Exposition at Philadelphia will be formally opened, coincidently with the last day's session of the Association of Edison Illuminating Companies, which meets on Tuesday of the same week at Philadelphia.

A week later the American Electro-Therapeutic Association meets at Willard's Hall, in Washington, commencing its sessions on September 19 and remaining in convention for three days. In October there are to be two conventions, the Pennsylvania Street Railway Association, at Lancaster, on the fourth, and the American Street Railway Association, at Chicago, on the seventeenth. On the other side the exercises in commemoration of the centenary of Volta will be celebrated at Como, Italy, on September 18, but they will be, unfortunately, diminished in interest by the effects of the recent fire in the exposition at that place. An international exhibition of automobiles is also now being held in Berlin.

THE EXPORT EXPOSITION.

The export exposition which is to be opened at Philadelphia in a few days is peculiarly opportune. It comes just at a time when American export trade is increasing in volume, and extending in influence beyond even the most ardent expectations of the commercial world. The recent conquests of American arms have apparently given renewed vitality to American commerce. Not only in the new territory which has been opened to our occupation, but on the continent of Europe, in South Africa, in Asia, and very notably in the British Isles, we have extended and enlarged our commercial interests until the United States is rapidly going ahead to a high place among exporting nations.

Whatever the reasons for this development may be, no one can deny that it is of the most vital importance to every citizen and that it is the surest guarantee of continued prosperity. The exposition comes when interest in export matters is at its height. It can not fail to accomplish a highly beneficial purpose, and, in common with every other attempt to increase the influence and importance of American industry abroad, it should have the earnest and cordial support of all who are in any way interested in commerce or manufacture.

STARTING INDUCTION MOTORS.

On another page is a deeply interesting abstract of recent work by two Italian engineers on the application of the liquid interrupter to the starting of single-phase motors. These machines, as is well known, operate successfully and with the greatest satisfaction when they are once in motion, but the problem of starting them has always been one of considerable difficulty; the methods in use to-day are so complicated that the machines have not come into general use. In looking forward to the application of alternating current to street railway work the slightest consideration of difficulties surrounding the use of more than two conductors shows that the only variety of current applicable is the single-phase. Consequently, any design that tends to simplify the methods of control for induction motors operating on this variety of current is of the highest importance, and Signori Grassi and Lori are to be congratulated upon having produced what is certainly an elegant solution, however practical it may prove under the test of actual use.

The form of liquid interrupter which they worked with is the classical instrument of Wehnelt, but those who have used this apparatus, even in the laboratory, are fully aware that it does not possess that certainty and continuity of action which is absolutely essential in practical operation. It will be interesting to note the results that will be obtained when the Caldwell form of liquid interrupter—that in which the interruption takes place by the thermal dissipation of a thin column of liquid—is tried for this purpose. This work seems to open a field of real practical importance for these apparatus which have hitherto been simply interesting products of the laboratory. If it should prove that through their agency the problem of starting single-phase motors is simplified, it will furnish another example to the many now existing of the extreme importance of scientific work which may not, for the moment, have an apparent practical value,

MUNICIPAL ELECTRICIANS AT WILMINGTON.

PROCEEDINGS OF THE FOURTH ANNUAL CONVENTION—GOOD ATTENDANCE AND INTERESTING EXHIBITION.

The fourth annual convention of the National Association of Municipal Electricians was held in Wilmington, Del., this week. The hospitality of the city officials and citizens of Wilmington was particularly cordial, and all the delegates and their ladies will have occasion to remember the occasion with much pleasure.

The sessions of the convention began at 10 o'clock, in the Grand Opera House, on Tuesday, September 5, President J. W. Aydon, of Wilmington, presiding. Addresses of welcome were delivered by Gov. E. W. Tunnell and Mayor John C. Fahey. Senator George Gray and a number of other distinguished state officials, including the Chief Justice and the officers of the association, occupied the platform. The welcoming addresses were responded to on behalf of the electricians by Mr. Morris W. Mead, of Pittsburgh, in a brilliant and brief address, voicing the gratitude of the delegates for the hospitable reception they had received. President J. W. Aydon followed with the president's annual address.

The exercises were pleasantly interspersed with music by an excellent quartette, and a regimental band also contributed to the entertainment.

In the afternoon Capt. William Brophy, chief electrician of the wire inspecting department of Boston, delivered his address, entitled, "The Licensing of Employés on Electrical Work." Additional papers and discussions followed, the convention concluding Wednesday with the election of officers and the selection of the next meeting place.

The sentence, "What Hath God Wrought," appeared, formed of incandescent lamps, over the stage of the Grand Opera House, and a large sign of "Welcome," composed of incandescent lamps, extended across the main street of the city. The business houses and hotels generally were decorated with electric signs and flags, and the citizens vied with one another in extending hospitality to the visitors. The Young Men's Democratic Club, the leading organization of its kind in the city, kept open house, and the Wilmington City Railway Company and the telephone and telegraph companies extended free service to all visitors wearing the badges of the association.

The list of attendants comprised, among others, the following:

From New York—William C. Callmann, T. J. Smith, F. W. Harrington, Edward Baines, Ditman Fisher, E. E. Pierce, George T. Manson, Fred Hendey, A. P. Eckert, Marcus Nathan, G. F. Porter, G. L. Wiley, C. W. Price, Frederick Pearce, Alexander Henderson, M. J. Leary, Charles W. Price, J. B. Taltavall, Frank L. Perry, W. L. Candee.

Boston—F. W. Ferlin, A. S. Clark, John Weigel, Thomas W. Flood, John D. Cornady, William Brophy.

Brooklyn—Newton H. Murphy, Michael E. Dougherty, W. A. Cooper.

Baltimore—S. A. Williams, F. G. Boyd.

Minneapolis—Charles K. Pillsbury, Z. L. Morrison.

Bridgeport, Ct.—William A. Barnes.

Elmira, N. Y.—Albert Bundy, W. Y. Ellet.

Chicago—Charles A. Rolfe.

Savannah, Ga.—W. D. Claiborne.

Ottawa, Can.—G. F. Macdonald.

Paterson, N. J.—J. F. Zeluff.

Newark, N. J.—Adam Bosch.

New Britain, Ct.—Captain T. H. Brady.

Pittsburgh, Pa.—M. W. Mead.

Utica, N. Y.—G. F. Breitenstein.

Peoria, Ill.—F. L. Michael.

Corning, N. Y.—F. P. Foster.

New Brunswick, N. J.—Charles Greenwalt.

Charlestown, S. C.—Lon Simmons and Arthur R. Rhett.

Richmond, Va.—W. H. Thompson.

Trenton, N. J.—U. G. Quigley.

Chester, Pa.—W. S. Sykes.

Capt. Wm. Brophy was elected president, and Pittsburgh selected as next meeting place, in September, 1900. F. C. Mason, of Brooklyn, was elected representative to Paris Exposition.

THE ELECTRICAL EXHIBITION.

The electrical exhibition in the Cycle Academy was formally opened Monday evening, Governor Tunnell touching a button at eight o'clock that started a number of bells to ringing. The First Regiment Band furnished excellent music.

This was the first electrical show ever held in the city of Wilmington, and its extent and interest reflect much credit on the managers. President Aydon and ex-President Frank C. Mason, of Brooklyn, have been very active in making the exhibition a successful one. A charge for admittance was made to all but exhibitors.

Among the list of exhibitors were the following wire companies: W. R. Brixey (Kerite), in charge of Mr. George F. Porter; Okonite Company, Limited, in charge of Messrs. W. L. Candee and Geo. T. Manson; Safety Insulated Wire and Cable Company, in charge of Mr. A. P. Eckert; John A. Roebling's Sons Company, in charge of Mr. F. W. Harrington; Standard Underground Cable Company, in charge of Mr. George L. Wiley; American Circular Loom Company, in charge of Mr. A. S. Clark; Montauk Multiphase Cable Company, in charge of Vice-President C. W. Price, with several assistants. The last named company attracted a good deal of attention by exhibiting a section of a house showing the method of wiring with its fire and burglar protection cable. The wire companies exhibited very handsome sample boards, that of the Safety comprising some samples of its deep-sea cable recently sent to the Philippines. The Okonite exhibit, among other features, presented a sample board arranged in the form of a big reel very handsomely gotten up, and showed also a large rubber biscuit. All these wire exhibits were arranged in parlor style.

Among other exhibits of interest, that of the Gamewell Fire-Alarm Company, of New York, and of the Rolfe Electric Company, of Chicago, were especially noticeable. The Gamewell, of course, is known to all the city electricians of the country, as it is probably included in 90 per cent of the fire-alarm systems of this country. The Rolfe Electric Company's exhibit was represented by Mr. Charles A. Rolfe himself, and consisted of strong current protectors, telephones, etc. A souvenir of link cuff-buttons was given out by Mr. Rolfe. The Baines Improved Primary Battery Company presented quite an interesting exhibit of its improved battery, and was in charge of General Manager Callmann.

Among local electrical exhibitors the Arrowsmith Electric Company, of Wilmington, presented quite an attractively gotten up exhibit, comprising electric fans and miniature incandescent lamps. Among other exhibitors were Mr. Fred Pearce, of New York; Morris & Company, of Wilmington; International Correspondence School, of Scranton; the Bundy Lamp Company, the Gordon Battery Company, Machado & Roller, William Roche, T. J. Smith, Garrett, Miller & Company, the Pyle Cycle Company and Robelen & Company, both the latter from Wilmington. The exhibits are expected to remain until Friday of this week.

Telegraphing the Dreyfus Trial.

Very complete arrangements, says the *Telegraph Chronicle*, of London, Eng., were made by the telegraph administration of France for the transmission of telegrams for Rennes. Altogether, from 1 o'clock in the morning to 4 o'clock in the afternoon of the first day, at which hour there was a diminution in the stress of work, the central bureau of the rue de Grenelle received from Rennes 200,000 words. Five supplementary wires were put on this, making six wires, which carried all the matter telegraphed to Paris from Rennes. The instruments used were a sextuple Baudot, four quadruple Baudots and a Hughes. The Baudot machine allows of the transmission of several dispatches simultaneously. Thus, the six wires on the first day carried twenty-three separate dispatches, running concurrently. Since the first day the amount of press matter originating at Rennes has more than doubled.

AMERICAN STREET RAILWAY ASSOCIATION.

DETAILS OF THE EIGHTEENTH CONVENTION.

The eighteenth annual meeting of the American Street Railway Association will be held at "Tattersalls," State and Sixteenth streets, Chicago, on October 17, 18, 19, 20, 1899. Papers will be read on the following subjects:

"Maintenance of Car Equipment."

"Modern Street Railway Shops, Their Design, Machinery and Shop Practice."

"Train Service and Its Practical Application."

"Investments in Street Railways. How Can They Be Made Secure and Remunerative?"

"Construction and Maintenance of Street Railway Tracks."

There will be a large exhibition of street railway supplies, every foot of space in the hall having been applied for. At a meeting of the executive committee held in Chicago, February 6, 1899, the following resolution was adopted:

Resolved, That the last day of the convention, Friday, October 20, be set apart for the systematic and careful inspection of exhibits by the delegates, and that all street railway managers be urged to send delegations from their mechanical, operating and accounting departments to inspect the same.

The annual banquet will be held Friday evening, when the officers elected will be installed. The headquarters of the association will be at the Auditorium Annex. The Auditorium is across the street and is under the same management. Chicago is noted for its good hotels, so no trouble will be experienced in securing good accommodations. Railroad rates will be as before, one and one-third fare for the round trip on the certificate plan.

Mr. Frank B. Knight, special agent of the American Bell Telephone Company, with headquarters at Austin, Tex., is visiting New York city.

THE FIELD OF EXPERIMENTAL RESEARCH.

BY PROF. ELIHU THOMSON.

(Concluded from page 139.)

Despite the diligent studies which had been made in the invisible rays of the spectrum, both the ultra red and the ultra violet, a work far from completion as yet, the peculiar invisible radiation of the Crookes tube remained unknown until the work of Lenard and Roentgen brought it to the knowledge of the world. The cathode discharge, studied so effectively by Hittorf and Crookes, and by the latter called "radiant matter," was but a part of the whole truth in relation to the radiation in high vacua. It is needless to recount the steps in the discovery of Roentgen rays. We now know that these rays come from the impingement of the "radiant matter," or cathode rays. We know also that the higher the vacuum, and, therefore, the higher the electric potential needed to effect the discharge, the more penetrating or the less easily absorbed is the resulting radiation. Rays have been produced which in part pass through cast-iron nearly an inch thick. The iron acting as a filter absorbs all rays of less penetrating power. A question may here be put, which it will be for future experiment to answer: Can we, by increasing the degree of vacuum in a Crookes tube by the employment of enormous potentials for forcing a discharge through the higher vacuum, produce rays of greater and greater penetrating power? What, in fact, may be the limit, or is there any limit, to the diminution of wave length in the ether, assuming for the moment that this invisible radiation is somewhat of the same nature as light, but of higher pitch, though it may be unlike light in not representing regular wave trains.

Roentgen radiation, while spoken of as invisible, is in reality easily visible if of great intensity. The parts of the retina which respond, and so give the sensation of luminosity, are apparently those around the eye and not directly opposite to the iris opening. Those parts of the retina sensitive to the rays are characterized by the preponderance of "rods," giving the simple sensation of illumination, apparently white in the case in question. The "cones," or those portions of the retinal membrane whose function is believed to be the recognition of color or differences of wave-length, appear not to be excited by the Roentgen radiation, or only very feebly. If this be true, it would account for the less intensity of the luminous effect upon those portions of the retina near the optic axis of the eye. All this favors the view that the Roentgen radiation is without sustained pitch or wave trains, and resembles more a sharp noise or crash in sound.

For pressing experimental work in the highest vacua to its limit, as above suggested, we already have means at command for the production of the most complete exhaustions, requiring extremely high potentials to pass an electric discharge. We have, also, in well known forms of high frequency apparatus, the means for producing electro-motive forces limited only by our means for insulation. A recent apparatus, devised by me and called a dynamostatic machine, gives equal capability of producing high potentials of definite polarity, positive and negative. It should not be long, therefore, before work is undertaken in this suggested direction of pressing this matter of rays of high penetrating power much farther than has been done. The question arises, whether any such rays can exist which are not appreciably absorbed in passing through dense substances. They would probably not affect a photographic plate nor a fluorescent screen. If they lost also the property of ionizing a gas and causing electric convection we might not even be able to discover them. That some influence or action in the ether does actually penetrate the dense masses in space is evidenced by gravitation, the mystery of mysteries. We are, however, not justified in going beyond the proved facts which can only be the result of experimental work and close observation. All else is speculation. The energy source of the Becquerel rays is another mystery apparently far from being cleared up, and if it be true, as recently announced, that a substance named radium has in reality 900 times the power of emitting these rays than is possessed by uranium and thorium, and that the radiation is able to cause visible fluorescence of barium platinocyanide, the mystery but deepens and makes us again think of the possible existence of obscure rays only absorbed and converted by a few special substances.

The diffusion which takes place when Roentgen rays pass through various media is another phenomenon which needs more attention from investigators. This effect seems to be produced by all substances in a greater or less degree. It, however, appears to be nearly absent in the case of those substances which give out light or fluoresce under the rays, as barium platinocyanide and calcium tungstate. It will be important to determine definitely whether the rays diffused by different substances are lowered in pitch or penetrating power as compared with the rays exciting the diffusion: whether, in other words, the rays from a tube with quite high vacuum excite similar rays by diffusion, or rays more absorbable; and if a lowering takes place whether it occurs in like manner and degree for all diffusing media.

The phenomenon may be akin to fluorescence, as when quinia sulphate converts the invisible ultra-violet rays of the spectrum into lower rays or visible light. This action may be at its extreme when barium platinocyanide, excited by Roentgen rays, so lowers the pitch as to produce rays within the visible spectrum, for this compound gives very little or no Roentgen-ray diffusion. Are there substances which under Roentgen rays fluoresce with invisible rays of the order of the ultraviolet of the spectrum? If, as is the case with solid paraffine, the irradiated substance gives rise to considerable diffusion it can, as I have noted, produce a secondary diffusion in other masses of the same substance, or of other substances, as indicated by feeble fluorescence of the sensitive barium salt, thoroughly screened from the direct source of rays and from the first or primary diffusion. It is probable that Tertiary diffusion could be found if we possessed a far more powerful or continuous source of the rays for exciting the diffusion. The ray emission, even in the most powerfully excited tube, is probably so intermittent that the active period is but a fraction of the total time. It may easily be that the limit of intensity of Roentgen ray emission has not yet been reached, especially when artificially cooled anti-cathode plates are available.

There is much room for experimental work in this fascinating field. We need for it the means for the production either of a continuous electric discharge at from 60,000 to 100,000 volts or a high-frequency apparatus capable of giving an unbroken wave train: that is, a succession of high period waves of current without breaks of intermissions.

The ordinary high-frequency apparatus for obtaining discharges of high potential from alternating currents gives only a rapid succession of discharges, each consisting of a few rapidly dampened oscillations. These discharges occupy but a small fraction of the total time. This is very different from a continuous sustained wave train, with the successive waves of equal amplitude following each other without break. Such sustained waves will, doubtless, be of use in research, especially in vacuum-tube work, and they would, of course, convey much more energy than the usual broken or interrupted discharge known as a high-frequency discharge.

Some six or seven years ago I endeavored, while working upon the subject of high frequency, to fill the gap. The result was an apparatus which, with its modifications, deserves more study and experiment than I have been able to give to it. A brief description may not be out of place. A large inductance coil, with a heavy iron wire bundle for a core, a coil of relatively few turns with no iron core, and a condenser of variable capacity, were connected in series across the mains of a 500-volt electric circuit. The smaller coreless coil and the condenser were arranged to be shunted by an adjustable spark-gap with polished ball terminals. By simply closing for a moment the spark gap so as to form a low-resistance shunt around the condenser and the small coil, and afterward slowly separating the balls, the local circuit of the condenser, small coreless coil and shunting gap become the seat of sustained oscillations, the frequency of which depends upon the relation of inductance and capacity in the local circuit. The energy supplied is that of a continuous current through the large inductance coil with the heavy core. The action of the apparatus is easily comprehended by a little study. The oscillating current in the local circuit may be made to induce much higher potentials in a secondary circuit inductively related thereto. In this case the turns of the secondary, in relation to the primary, are, as usual, such as to step-up the potential. In other words, the potential developed in the secondary is determined by the transforming ratio.

We thus have a high-frequency apparatus in which the waves are sustained in an unbroken series, and we employ as the source of energy a continuous current circuit. It shows that we may continuously supply energy to an oscillating system and so keep up the amplitude of electric oscillations, the frequency of which is that due to the capacity and inductance of the part of the circuit in which oscillations are set up.

While, in the forms of high-frequency apparatus alluded to, we may obtain almost any differences of electric potential up to millions of volts, assuming the apparatus large enough for the work, we do not get a sustained separation of positive and negative charges, as in the static machine, or in a less complete degree with the inductive coil. Professor Trowbridge, of Harvard, has, however, made use of large Planté rheostatic machines, the condenser places of which are charged in parallel from 10,000 small storage cells connected in series. The discharge of the condenser plates is effected after they are connected in series by a suitable connection changing frame moved for the purpose. Very high potential discharges are thus obtained and the polarity is always definite. It is manifest that the size of the apparatus and the perfection of its insulation determine the possible performance. The objection to such an apparatus for experimental research or demonstration is the large number of cells required and the complicated arrangements of circuits for charging them. I have, however, recently succeeded in removing all necessity for the presence of charging cells, and have produced what may be termed a dynamostatic machine, which is worked by power or by current from a lighting circuit, either continuous or alternating, and may replace a static machine. It is, of course, not dependent upon the weather. I trust it may be of sufficient interest to merit the following brief description: A small electric motor has in addition to its commutator a pair of rings connected to its armature winding for obtaining alternating currents. The shaft of the motor drives synchronously a revolving frame bearing connections which, as in the Planté rheostatic machine, connect a series of condenser plates alternately in parallel for charging and in series for discharging at high potential. A small oil-immersed, step-up trans-

former has its primary connected to the brushes bearing upon the two alternating-current rings of the motor, and its secondary, giving say 20,000 volts, is periodically connected to the condenser plates while in parallel, by means of the revolving connection frame. The adjustment is such that only the tops of the alternating waves or their maxima are used to charge the condenser plates, while, also, those halves of the waves which are of the same polarity are alone used, the others being discarded or left on open circuit. The apparatus may be driven by power, in which case the electric motor becomes a dynamo, exciting its own field and supplying alternating current to the primary of the step-up transformer, or suitable alternating currents may drive it as a synchronous motor. Such a machine, run by continuous currents and having only 11 plates, gives sparks between its terminals over 12 inches long in rapid succession. It can be built cheaply, and is a highly instructive machine from the transformations it illustrates.

The machine is also arranged by the addition of a simple attachment, so that it may be used to charge insulated bodies, or to charge Leyden-jar condensers or the like, replacing the ordinary static machines. It might, in fact, be used to charge a second range of condenser plates in another rheostatic machine to a potential of 100,000 volts, for example. These, after coupling in series or cascade, might be made to yield potentials beyond any thus far obtained.

The interest in such experimental apparatus and the results obtained come largely from the apparent ability to secure a representation of the effects of lightning discharges upon a moderate scale, and the possibility of studying the action of air and other gases, as well as liquids and solids, at varying temperatures and pressures under high electric stresses. Broadly considered, however, the similarity of the effects to those produced in a thunder cloud is more apparent than real. The globules of water constituting the electrified cloud do not possess charges of millions of volts potential, the effects of which are seen in the stroke of lightning. The individual globules may possess only a moderate charge. When, however, they are massed together in a large extent of cloud the virtual potential of the cloud as a whole, with respect to the earth, may be enormous, though no part of the cloud possesses it. The cloud-mass not being a conductor, its charge can not reside upon its outer surface or upon its lower surface nearest the earth, as with a large insulated conductor. The charge, in fact, exists throughout the mass, each globule of water suspended in the air having its small effect upon the total result.

When the cloud discharges, the main spark branches within and through the cloud-mass in many directions. The discharge can at best be only a very partial one, from the nature of the case These are conditions which are certainly not represented in our experimental production of high-potential phenomenon, except perhaps upon a very small scale in the electrified steam from Armstrong's hydroelectric machine, a type of apparatus now almost obsolete. Yet if we wish to reproduce, as nearly as possible upon a small scale, the conditions of the thunder-cloud, we shall be compelled to again resort to it. In volcanic eruptions similar actions doubtless occur and give rise to the thunder clouds which often surround the gases sent out from the crater.

Considering, then, that the conditions in the thunder-cloud are so different from those in our experiments with high potentials, we can easily understand that the study of lightning phenomena may present problems difficult to solve. Two forms at least of lightning discharge are quite unknown in the laboratory —namely, globular lightning and bead lightning, the latter the more rare of the two. Personally I can not doubt the existence of both of these rare forms of electric discharge, having received detailed accounts from eye-witnesses. On one occasion, while observing a thunder-storm, I narrowly missed seeing the phenomenon of globular lightning, though a friend who was present, looking in the opposite direction, saw it. The explosion, however, was heard, and it consisted of a single detonation like the firing of a cannon. According to the testimony of an intelligent eye-witness, who described the rare phenomenon of bead lightning within an hour after it had been seen, it is a very beautiful luminous appearance, like a string of beads hung in a cloud, the beads being somewhat elliptical and the ends of their axes in the line of their discharge being colored red and purple respectively. This peculiar appearance, not at any time dazzlingly bright, persisted for a few seconds while fading gradually.

Again, our knowledge of the aurora is not as yet much more definite or precise than it is in regard to the obscure forms of lightning alluded to above. Whether these phenomena will ever be brought within the field of research by experimental methods is an open question.

The endeavor in the foregoing rather disconnected statements has been to indicate directions in which the field of experiment may be extended, and to emphasize the fact that research must be carried on by extension of limits, necessitating more liberal endowment of research laboratories. I have tried to make it clear that the physicist must avail himself of the powers and energies set in play in the larger industrial enterprises, and finally that the field of possible exploration in physics by experimental methods has its natural boundaries, outside of which our advances in knowledge must be derived from a study of celestial bodies.

The riddle of gravitation is yet to be solved. This all permeating force must be connected with other forces and other properties of matter. It will be a delicate task, indeed, for the total attraction between very large masses closely adjacent, aside from the earth's attraction, is very small.

Scientific facts are of little value in themselves. Their significance is their bearing upon other facts, enabling us to generalize and so to discover principles, just as the accurate measurement of the position of a star may be without value in itself, but in relation to other similar measurements of other stars may become the means of discovering their proper motions. We refine our instruments; we render more trustworthy our means of observation; we extend our range of experimental inquiry, and thus lay the foundation for the future work, with the full knowledge that, although our researches can not extend beyond certain limits, the field itself is, even within those limits, inexhaustible.

A Remarkable Polyphase Generator.

At the recent ill-fated exhibition at Como, Italy, there were exhibited a considerable number of heavy machines of Italian make. Our London

A CURIOUS INDUCTOR ALTERNATOR.

namesake describes the apparatus illustrated in the accompanying figure, which is made by Messrs. Brioschi, Finzi & Company, of Milan. It is a three-phase inductor alternator of a type which has been constructed for some 12 months with great success, and which presents some interesting features. The output is 150 kilowatts at 900 volts. As will be seen from the figure, the field winding is not only fixed, but is wound in slots on the same laminated core as the armature winding. In the particular machine under consideration, the inner and outer sets of coils form the field, while the armature coils, which are of the ordinary type, are "sandwiched" in between them, thus reducing magnetic leakage to a minimum, though, of course, making efficient insulation more difficult at high voltages. It will be readily seen that, as the six laminated poles revolve, the permeance changes in such a way as to cause the field to rotate, and in so doing to cut the armature conductors. These machines, which are said to be slightly more expensive than those with revolving magnet coils, have the great advantage of enabling the armature and field coils to be replaced with the greatest ease, and without its being necessary to remove the magnets.

Another Cleveland Street Car Dynamited.

During the past two weeks numerous petty acts of violence have been committed by striking employés against the cars and men employed by the Big Consolidated Street Railway, of Cleveland, Ohio, and against passengers who rode on the company's cars. On the night of August 30 a Wilson avenue car was dynamited, with serious results. There were 18 passengers on the car, all of whom were hurt, six dangerously so. The motorman and conductor were also seriously injured. Window panes in houses for several blocks around were shattered by the concussion. The company has offered a large reward for the detection of the persons who caused the explosion.

Money Found in the Mail Bags.

"It seems almost incredible that in the neighborhood of $40,000 in actual cash should have been confided to letters during the last year, and harder still to credit that the most exhaustive efforts failed to find the owners of one-fourth of that amount," writes Patti Lyle Collins in *The Ladies' Home Journal* for September. "The envelopes which are addressed are kept on file for four years, blank ones not so long, but in either case a liberal margin of time is allowed for claimants to appear before the money is finally turned into the treasury to the credit of the post office department. In addition to the money contained in letters during the same period, something like $10,000 was found loose in the mails. It is officially styled 'loose money.'"

The Quincy Light and Power Company and the Empire Light and Power Company, of Quincy, Ill., have filed a certificate of consolidation under the name of the Quincy Gas and Electric Company; capital stock, $600,000.

The ELECTRICAL REVIEW has received the fourth annual report of the Public Lighting Commissioner of the city of Detroit, Mich., for the fiscal year ended June 30, 1899.

THE ADVISABILITY OF CONCENTRATING THE CONTROL OF ALL MUNICIPAL ELECTRICAL INTERESTS UNDER ONE HEAD.

READ BEFORE THE NATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS, WILMINGTON, DEL., SEPTEMBER 6, 1899, BY MORRIS W. MEAD.

"The Advisability of Concentrating the Control of All Municipal Electrical Interests Under One Head," which is the subject of the paper I have been requested to present by the board of directors, should, it seems to me, need no argument beyond the mere statement. If any one of the membership of this association was asked to name the most pronounced tendency of our times, that which is most strongly and plainly marked upon the horizon of business, political, social or religious development, nine out of ten, either upon the instant or after mature reflection, would say the concentration of authority and responsibility.

We live in a period when systematized effort is the word and work of the day; in a period when to make that system effective and successful, we must either lead or acknowledge a leader.

There seems to be no more jumbling together of heterogeneous ideas, no more undefined or irregular running hither and thither of people like animals, without a perfectly developed plan of action.

In politics it has given us the "boss," so-called (although no boss holds his power unless he keeps carefully in touch with the party organization which he represents).

In the industries it has given us the "trust," which is only another expression for reaching the best and most economical methods of production, by wiping out the middle man's business, and, incidentally, his profits.

I venture to make conspicuous illustration from the city where I live: The Carnegie company makes all forms of steel, from the armor plates of battle-ships down to the couplings which join rails together. It was not so long ago that one concern quarried the ore, another took the coal and converted it into coke, and the final process by which the combination of the two was made ready for the market was all that the Carnegie company did.

It is different now; they own their own coal fields and make their own coke. They own their own ore mines, also the lake steamers which bring it to the railroad, of which they own the majority of the stock. Thus, from the depths of the earth to the salesroom of the finished steel, there is no skip from the direct control and responsibility of the great company, which gives its name and vouchers to the quality of the product.

I speak of it only as a large example, which every one of you gentlemen can, no doubt, duplicate from your own cities.

Therefore, we live in an age when systemized effort is the word for the hour, and system demands concentration under one authority.

AN ENAMEL-INSULATED BRIDLE RING.

What would have been thought of sending our fleet out to fight Cervera, with each captain instructed to sail his ship where he pleased, and fight it as seemed good to him?

How much of a load could you haul with the best four-horse team that ever wore harness if each horse had a separate driver?

Thus, the tendency toward individual control and consequent responsibility runs through all the various fields of human effort.

I own no stock in the Standard Oil Company, but I can not but acknowledge that it is a most shining example of the benefits resulting from concentrated authority.

I am a Protestant by birth and breeding, but I can not be blind to the fact that the Roman Catholic Church, with its control and direction vested in one head, has kept in the front rank of all religious organizations of the world.

In our city of Pittsburgh, in electrical matters, we have had concentrated control and individual responsibility from the beginning. First, as of course in all cities, originally, came the fire alarm telegraph—when the police telegraph was added to the fire-alarm system it was put under the same control—when the sudden development of electrical street railways demanded municipal supervision for the safety of the public, the execution of the ordinances in so far as they dealt with the electrical apparatus, was vested in the same bureau.

When the rapid extension of electric lighting in private houses made it essential that there should be some oversight of it in the general public interest, the duties of inspection and supervision were added to the same office.

When the underground ordinances were passed, compelling all companies to place their wires beneath the surface of the earth, the duty of looking after the overhead dead wires, and seeing that they were not left a menace to the innocent public, was delegated to the same head, to compel their removal, peacefully, if it could—forcefully, if it must.

Speaking from an experience of more than 20 years, as the controlling head of this branch of municipal work in Pittsburgh, I can only say that I can not conceive of doing business successfully under any other system.

When anything goes wrong in one branch of the operations, we should be able to throw the force of all branches of the same kind of work into the task of setting it right; if there is a break in the police wires, we should be able to call into a helpful action all interest of the fire-alarm, its men and conveniences, at any hour of the day or night, without the "red-tape" necessity of hunting up a separate department authority to get permission.

If live wires cross each other by accident, and one of them does damage, there ought not to be two chiefs of different bureaus with equal authority to fix the blame or estimate the loss.

It seems to me that the additional safeguards it gives the public, in all the ways I have indicated, gives this same public the right to demand, at the hands of the proper legislative power, that they grant this highest safeguard; for goodness knows that taxes are usually high enough, and "the best is none too good" when it comes to the salvation of life and property. In fact, I think the argument for concentration of authority in municipal electrical work is so old that one can not hope to say very much new upon it, and it is so plainly apparent that it stands in front of every intelligent person who may stop in the midst of the whirlwind of every day experience, and cast a side look about him.

The question of the hour is how to reform municipalities. It seems to me that if those in charge of any public function were so trained or educated as to be able to take charge of any or all portions of similar work, or the different branches of the same work—in other words, show a thorough competency that much of the clamor for municipal reform would be done away with.

For instance, in the subject under discussion, a police telegraph superintendent should be able to run the fire-alarm system; he should also be able to understand all the rules governing good electric light installation in buildings. He should understand, to a great extent, electric light machinery, as well as have a thorough knowledge of motor and power work.

(To be concluded.)

Association of Edison Illuminating Companies.

The annual meeting of the Association of Edison Illuminating Companies will begin in Philadelphia on Tuesday, September 12, and continue through Wednesday and Thursday. The headquarters will be at the Hotel Lafayette, and the association will be the guests of the Edison Electric Light Company of Philadelphia, who have arranged an elaborate programme of entertainment for the visiting members and their wives. Papers will be read on electromobiles, meters, lamp testing, station accounts, stationary motors, station practice and statistics. The sessions will, as usual, be open only to members of the association.

Enamel-Insulated Bridle Rings.

The accompanying illustration represents a simple and useful device intended for use in carrying wires along the sides of buildings, etc. It is constructed of drop-forged iron, the eye being 1⅝ inches in diameter, and is heavily enameled to secure insulation. The side of the eye opposite the threaded shank is open, as shown in the illustration, so that wires may be slipped into place or withdrawn after the ring is in position. The surface of the enameled metal is stated by the makers, Messrs. James S. Barron & Company, 24 Hudson street, New York city, to be free from all qualities likely to injure wires or small cables hung up in the rings.

Mr. Edison Denies a Rumor.

Mr. Thomas A. Edison authorizes the ELECTRICAL REVIEW to deny the report that he has purchased the Ortiz land grant in New Mexico. He is, however, building an ore-extracting machine for a gold-mining company in that territory.

The Latest Disease.

"What was the matter with that cab driver you were called to see last week?" asked Dr. Squills.

"As nearly as I can describe his case," answered Dr. Kallomel, "it is automobiliousness."—*Chicago Tribune.*

Wall Street and the Electrical Stock Market.

Although the general financial situation is strong and encouraging, it was but slightly reflected in the stock market for the current week. Stocks that usually take the lead in speculation were almost at a standstill and practically neglected. The principal movements occurred in the industrials and certain specialties. The uncertainty of the developments in the money market for the next two months act as a curb on speculation at the present time. The unsettled situation in France and the critical state of affairs in South Africa militated, to some extent, against greater activity during the week.

On the New York Stock Exchange General Electric closed the week at 124 bid and 125 asked, showing a rise of 1 point for the week. Metropolitan Street Railway, of New York, closed at 205¾ bid and 208 asked. Third Avenue Railroad, of New York, closed at 181 bid and 185 asked. Brooklyn Rapid Transit closed at 104¼ bid and 104½ asked, showing a rise of ⅜ of a point for the week.

On the Boston exchange American Bell Telephone closed at 363 bid and 364 asked, showing a gain of 16 points for the week. Erie Telephone closed at 102 bid and 103 asked, a gain of 1 point for the week.

On the Philadelphia exchange Electric Storage Battery common closed at 145 bid and 150 asked. Union Traction closed at 41½ bid and 41⅝ asked, a gain of ⅛ of a point for the week.

On the curb, or outside market, in New York Electric Vehicle closed at 105 bid and 107 asked. Electric Boat closed at 15 bid and 20 asked.

Wall Street, September 2.

WESTERN ELECTRICAL TRADE NOTES.

The Illinois Electric Company, Madison street, Chicago, are preparing to send to the various telephone exchanges throughout the country their new catalogue of telephone supplies. The company claim their business in this particular branch has been very good and are looking forward to a large Fall trade.

Chas. E. Gregory Company, 58 to 62 Clinton street, Chicago, state that the demand made for second-hand electrical machinery is constantly increasing, and, as a consequence, their factory, in which machines are bought and put in first-class order, ready for service again, is taxed to its utmost capacity.

The Farr Telephone and Construction Supply Company, of Chicago, issue a monthly bulletin of supplies and telephone material which is sent regularly to their customers. President Farr says his company is enjoying an excellent trade.

The Stromberg-Carlson Telephone Company, of Chicago, say they have already enough orders on hand to keep their entire force busy for many weeks. With the new exchanges at St. Paul and Minneapolis nearing completion, and several other large exchanges in course of construction, it will be seen that this company is getting its share of business.

The Smith Interchangeable Telephone Company, of Chicago, have put upon the market a lineman's test set which they claim greatly facilitates the work of the lineman. It has met with universal favor, has been tested under all conditions and is fully guaranteed. The company will be glad to mail circulars on application.

The Central Electric Company, of Chicago, state that they are fully stocked to meet the requirements of Fall construction needs of all standard material for electric light and power, electric street railway and telephone work. The sales of Bullock Electric Manufacturing Company's apparatus, for which the Central Electric Company are agents, has been very brisk.

F. E. C.

A Handsome Electromobile "Break."

Perhaps the most interesting recent developments in electromobiles are the handsome private vehicles which are being manufactured to-day. The illustration herewith represents an electromobile "break" manufactured by the American Electric Vehicle Company, of Chicago, and it also shows Mr. C. E. Corrigan, the president of the company, who was conducting the machine to the great gratification of several of his friends. This carriage has a capacity for five passengers, the rear seat being wide enough to accommodate three. A notable feature is the flat-tread tires, which are so clearly shown in the illustration as to need little further description. They consist of a three-inch, nearly square, rubber tube in combination with a solid ¾-inch rubber facing, thus combining the advantages of solid and pneumatic tires in a very practical way. The "break" has wood-spoke wheels, 36 inches in diameter at the rear and 32 inches in diameter in front. Steering is accomplished by turning the front wheels, the handle working very easily, even when the machine is moving at a slow speed. The motor is geared to the rear axle. It is of the four-pole type, giving normally three kilowatts, though capable of an output of nine horse-power for a short time. The pinions are of combination metal, running in cut steel counter-gear. An ingenious arrangement is used for attaching the motor to the running gear of the vehicle. The armature shaft is hollow and the countershaft runs through it. The differential gear, used to permit one wheel running ahead of the other on curves, is mounted in this countershaft. The body of the vehicle contains the accumulator equipment of 44 cells of 120 ampere-hours capacity. These accumulators are made by the company, which also manufactures the motors and turns out its vehicles complete from its own shops. The control is effected in the usual way by a handle on the left of the driver, five speeds being provided, the maximum of about 16 miles per hour on level, fairly good roads. At medium speeds and under ordinary conditions the vehicle can travel about 50 miles on a single charge. A very complete system of braking is used on this carriage, a friction brake working on the flange of the counter-gear, while an auxiliary brake operates on the periphery of the differential gear-casing. The vehicle is fitted with ball bearings all over, and runs with great smoothness and without noticeable noise. It is provided, as the illustration well shows, with electric headlights and side lamps, and, in its neat coat of yellow and brown with silver trimmings, presents an extremely handsome appearance.

AMERICAN ELECTRIC VEHICLE COMPANY'S ELECTROMOBILE "BREAK."

A Military Automobile Experiment.

Major R. P. Davidson, United States Army, will leave Chicago for Washington in a few days on an automobile cannon carriage, carrying a Colt's automatic rapid-firing machine gun and 2,000 rounds of ammunition, together with all the necessary tools and several days' supply of fuel. It is Major Davidson's intention to make this trip a demonstration of the military capacities of the automobile, and it is expected that he will show that light artillery of this character can cover more ground in two days than the ordinary horse-drawn battery can traverse in a week.

The Sterling Electric Company, of Chicago, report the sale of exchange equipment, consisting of switchboard, cross-connecting and distributing board and arresters, to the Galena, Kas., Telephone Company, to be delivered and installed by September 15.

AUTOMOBILE NOTES.

An order for 4,200 electromobiles, to cost $1,000,000, has just been placed by the Electric Vehicle Company, of New York.

It is again reported that the New York Central & Hudson River Railroad intends to establish an electric cab service in New York and other large cities on its lines.

It is stated that President Cassatt, of the Pennsylvania Railroad Company, is much pleased with the sample vehicle furnished by the Pennsylvania Electric Vehicle Company, and it is understood he favors the substitution of the Pennsylvania Vehicle Company's carriages at the stations of the company's system.

A meeting was held in New York city last week at which steps were taken to form the American Automobile Company, to control, operate and manufacture kerosene and gasoline automobiles. Capital, $10,000,000. The company will be financed by the Colonial Trust Company. It is said that New York and Philadelphia traction interests are largely interested in the company.

The following letter from a correspondent appeared recently in the New York *Sun*: "There appears to be a great desire to name something of importance after Dewey, and a great desire also to confer a better name on the automobile. Call it Dewey. Honor the man and glorify the thing by giving it his name! And why not a formal public christening as part of the Dewey celebration?"

The city of New York will provide Chief Croker of the Fire Department with a gasoline automobile for use in going to fires. He tried one last week which weighed 400 pounds and is claimed to have a speed of 40 miles an hour, with a working radius of 100 miles on one charging. Chief Croker expressed himself as satisfied with the machine when he returned from his ride. He is quoted as saying that in his opinion before very long all fire apparatus would be run either by electricity or compressed air. As Richard Croker's nephew he is naturally in favor of compressed air.

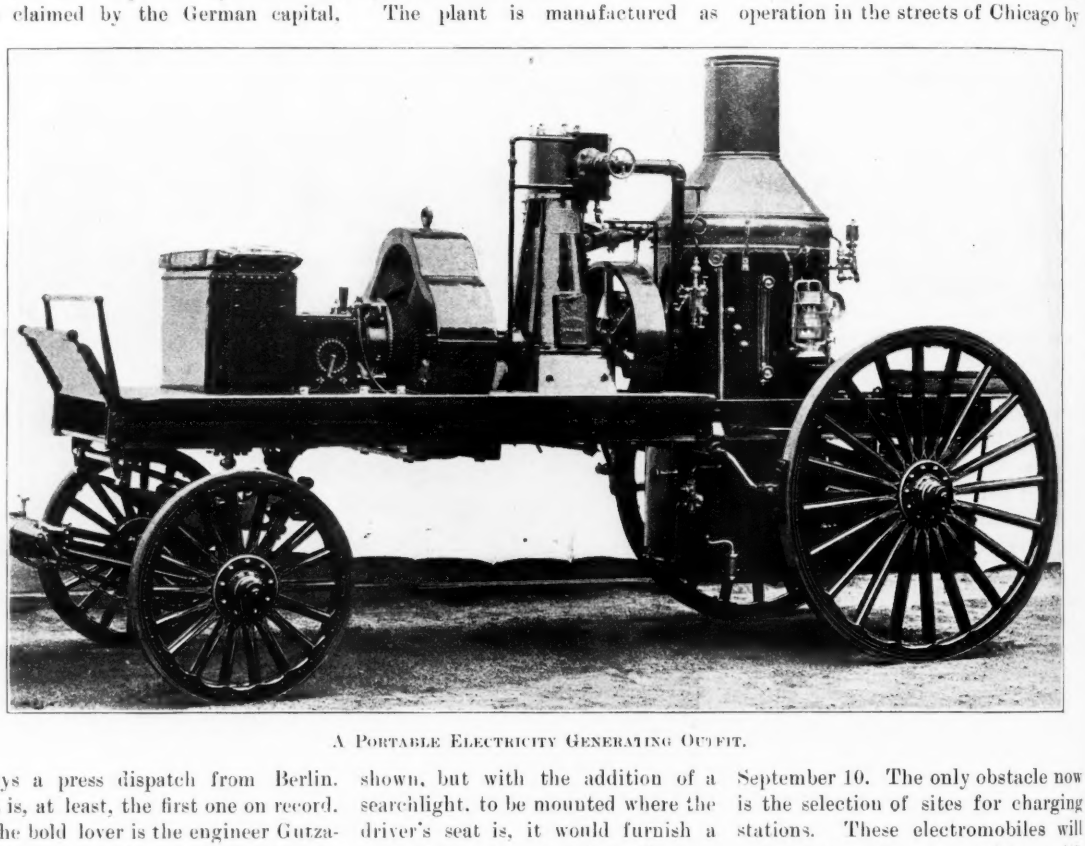
A press dispatch from the Fabyan House, N. H., says that the first automobile to make the ascent of Mount Washington, 6,300 feet above sea level, arrived at the summit shortly before noon on August 31. In the carriage were Mr. and Mrs. F. O. Stanley, of Newton, Mass. They left Newton on August 26, and made their way leisurely to the White Mountains. The climb up Mount Washington began at Pinkham Notch. The distance of 10 miles was covered in 2 hours and 10 minutes. This time included delays in replenishing the water tank. The time is less than half that required by the teams that make the trip with carriages. Mr. Stanley had never been over the carriage road, which was opened this year, and he said he could reduce the time to 90 minutes on another trial.

The first elopement by automobile is claimed by the German capital, says a press dispatch from Berlin. It is, at least, the first one on record. The bold lover is the engineer Gutzaloff, who had fallen in love with the 16-year-old daughter of a wealthy manufacturer of underwear, Herr Rodolf Heinrich. Gutzaloff, undaunted by a prior failure to get his bride and by the parents' refusal to allow him to call at the house, managed to keep up a secret communication with Elsa. He went to a friend and asked him for the loan, for a few days, of his automobile. Three days later he sent word to his friend to come and get his carriage in Stettin, where, with Elsa, he had taken a boat to St. Petersburg, and where the couple were married. Herr Heinrich has telegraphed to the automobile elopers to return to Berlin at once, where parental forgiveness awaits them.

A Portable Lighting Outfit.

The illustration herewith shows a remarkably compact portable electric generating outfit, consisting of a boiler, engine and direct-coupled, direct-current dynamo. The outfit, as shown, consists of a channel-beam truck, mounted on four heavy wheels, carrying a standard vertical fire engine boiler and a vertical single-cylinder Shepherd engine. This is direct-coupled to a four pole dynamo, of what is known as the "clover leaf" type, manufactured by the Onondaga Dynamo Company, of Syracuse, N. Y. The machine is adapted to be drawn by two or three horses.

The plant is manufactured as shown, but with the addition of a searchlight, to be mounted where the driver's seat is, it would furnish a convenient and powerful auxiliary for certain military operations, and might be used with the greatest advantage on the field of battle. In the war between China and Japan some years ago outfits of this sort were hastily put together from such material as could be found, and are said to have been of great value to the Japanese landing forces. The wild inhabitants of Korea were more terrified by the brilliant searchlights than by the arms of the attacking force, and it appears that some of our new citizens in the Philippines might have a similar regard for the electric light. It is to be regretted that the outfit, as it stands, is not provided with motors on its rear wheels and a steering handle to control the forward ones. Under these circumstances it would be an electric light and power generating automobile, and would find a multitude of uses for both civil and military purposes. For emergency electric construction work at night it would be of great value.



A PORTABLE ELECTRICITY GENERATING OUTFIT.

Public Electromobile Cabs in Chicago.

A press dispatch from Chicago states that the Illinois Electric Vehicle Transportation Company, with a capital of $25,000,000, will have a score or more of electromobiles in active operation in the streets of Chicago by September 10. The only obstacle now is the selection of sites for charging stations. These electromobiles will enter into active competition with public carriages and cabs, and the tariff, it is said, will be considerably cheaper than that now in vogue.

American Trade in the Far East.

The State Department has begun an investigation of the effect on American trade of the establishment of European "spheres of influence" in the Orient.

The plant, machinery and other property of the Rappahannock Electric Light and Power Company have been sold at Fredericksburg, Va., at public auction for $2,025 to G. W. Shepherd for the parties secured in the deed of trust.

ELECTRIC RAILWAY NOTES.

Three of the principal railway systems of Seattle, Wash., have become the property of a Boston syndicate, and a fourth road will soon be transferred to the same people. The purchase price for the four lines is about $2,500,000.

Pekin, China, now has an electric railroad, running from the south gate of the city to the steam railroad station, and it is hoped that permission to enter the city itself may be obtained soon. The road was built by a German firm.

The Louisville, Ky., Railway Company has compromised with the city on its franchise tax bill. The compromise is believed to be on the basis of 70 per cent of the $400,000 which city officials claim was due on bills covering the past five years.

The New York State Board of Railroad Commissioners has granted permission to the Staten Island Rapid Transit Railway Company to issue a second mortgage of $2,500,000 for the purpose of carrying out the scheme of reorganization of the property.

The Jamestown, N. Y., Street Railway Company is one of the few —it is to be hoped—electric railways that are still under kindergarten management. Cars run to Lakewood, and passengers from the popular Kent House there take them to connect with the Erie road at the Jamestown depot. A recent slight breakdown, that the motorman admitted could have been remedied if he had possessed a screwdriver, caused a number of passengers to miss the Erie connection and lose an entire business day. Such inefficient management is inexcusable in electric railways of the present day.

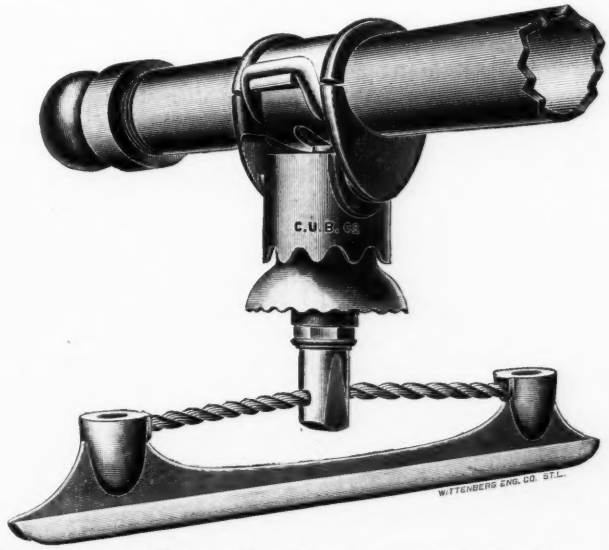
Bridge Commissioner Shea, of New York city, has abandoned his efforts to compel the trolley companies to pay a toll of 10 cents for each car crossing the Brooklyn Bridge. After Mr. Shea had forced the elevated lines to pay an increased toll, he announced that he would compel the trolley companies to pay 10 cents instead of five cents on each car. Mr. Shea has, however, been advised by counsel that it is questionable whether he could break the agreement made with the trolley companies by his predecessors in office, and as the present contract has eight years yet to run, it is not likely that the existing condition of affairs will be changed for a considerable time.

The Bristol, England, Tramway Company has just signed a contract with the British Thomson-Houston Company, Limited, in connection with the large extensions of the road now in progress. The order includes four 500-kilowatt tramway generators, coupled direct to vertical cross compound engines of the Corliss type, together with three 30-kilowatt motor generators and two 50-kilowatt lighting machines, also a complete switchboard for this machinery. The contract also calls for 150 single-truck, double-deck cars, each of which will be equipped with two No. 52 motors, series-parallel controllers and magnetic brakes. The British Thomson-Houston Company are to act as English representatives for the General Electric Company. Not having the facilities necessary for building the machinery embodied in this contract, everything pertaining to the electrical part of the order, the amount of which is estimated at quite $100,000, will be constructed in the American works of the General Electric Company.

A New Electric Brake Company.

The Hubbard Brake Company has been incorporated in Delaware, with a capital of $1,000,000, for the purpose of manufacturing electric brakes, under the Hubbard patents, and also brake appliances. The incorporators and officers are M. G. Hubbard, president and general manager; G. E. Pratt, vice-president; Chas. Gilpin, Jr., secretary and treasurer. The company's office and works are located at 126 to 130 Sixth street, Chester, Pa.

The machinery is being installed and operations will begin at once with orders in hand. The company is now installing brakes on the large double-truck open cars of the Spring City & Phœnixville Railway, and before long a large number of brakes will be in operation around Philadelphia and as far west as Chicago. It is stated that engineers who have examined the brake and seen it in operation pronounce it perfect and practical. Among the many claims made for the brake, is one, which all railway men will appreciate, the non-sliding and flattening of wheels. The brake is simple and of few parts, and the braking is done by a joint cylinder which is bolted under the center of the car to which the fulcrum and brake levers are attached. The brake is applied to all wheel treads.



WOOD'S FLEXIBLE TROLLEY EAR, COMBINED WITH THE "GEM" SWIVEL BRACKET HANGER.

The motorman's controlling handles are placed on either platform, and so arranged that he can not make any mistakes or become confused in emergencies.

Mr. Hubbard, the patentee, was for many years the engineer of the McGuire Manufacturing Company, and his trucks, snow-sweepers and other inventions are well known throughout the country. Mr. Hubbard and Mr. Pratt are well known in railway circles. The secretary, Mr. Chas. Gilpin, is widely known in the iron and steel trades, being secretary of the Andover Iron Company, and connected with other large concerns.

The management of the Massachusetts Electric Companies, which controls a large number of electric railways, estimates that the gross earnings of the constituent companies for the year ended September 30, will show an increase of $400,000, four months of which time the roads have been under the management of the Massachusetts Electric Companies.

Wood's Trolley Ear.

For some time past the rigid-bracket construction in electric railways has been a source of annoyance owing to the continual hammering against the clips or supports of the trolley wheel, this in turn causing sparking at these points with resultant crystallization of the trolley wire. This crystallization is said to be by far the largest cause of the breakages of the trolley wire, which not only stops traffic, but sometimes endangers life.

When the flexible pole brackets were introduced it was supposed this trouble would be overcome, and without doubt it has been reduced, yet the additional cost of the flexible pole-bracket construction has prevented a large number of roads from availing themselves of this improvement.

The "Gem" swivel bracket hanger, when combined with Wood's flexible trolley ear, as illustrated herewith, presents a device which can be used in connection with rigid and pole brackets, quickly transforming these into a flexible unity. The Wood's trolley ear consists of a 12-inch clincher ear, with brass bosses at each end, in which is cast the ends of a piece of flexible span wire. This piece of span wire flexibly supports the center boss, to which is attached the insulating bolt which is held in a swivel cap. This cap (which has the feature of beaded skirt) is permitted a lateral play through an arc of 30 degrees in the castings which clamp around the rigid bracket pipe. This swivel cap is attached to the lower casting by means of two cast lugs on the cap engaging in corresponding sockets in the casting. When the castings around the pipe are fastened in proper position, then the swivel cap, with the attached ear, is automatically hung into position by means of a center lug playing in a slot of the lower casting. This lug, while permitting freedom of swivel-cap action, yet will strike the iron pipe and thus force the side lugs to remain in their respective sockets. The swivel cap, with the flexible ear, is easily removed when desired without taking the castings from the pipe. This is done by removing the cotter pin and loosening the nut for three-eighths of an inch, and then lifting the cap out of the lug sockets. The "Gem" swivel bracket hanger, with the Wood's flexible trolley ear, is claimed to give most reliable and saving results. The Central Electric Company, Chicago, are much pleased with the demand for this article.

The Electric Street-Car System of Hamburg, Germany.

The electric street-car system of Hamburg is claimed to be in every respect the best and most complete on the Continent, exhibiting peculiar features both in its construction and its management, says Mr. Hugh Pitcairn, in a United States consular report.

It is an especially interesting fact that the whole plant is the result of American invention, having been built after the Thomson-Houston system by the Union Electricity Company for the joint stock company called the "Hamburger Strasseneisenbahn Gesellschaft."

Up to about four years ago the old horse cars on some lines and small steam cars with trailers on others were the modes of street-car transit in this city, but the perfection of electrical locomotion and appliances caused an entire revolution.

The company was established with a capital stock of 21,000,000 marks ($4,904,000); its rolling material consists of 500 trolley cars and 400 smoking cars, hereafter described. It was with great difficulty that the wires could be strung, as on narrow streets and on those where traffic is extensive the state prohibited the company from setting up the poles. The company therefore had to make arrangements with the different owners of the houses on both sides of the streets, to obtain permission to anchor the cross wires to their walls, to which there could be raised no objection, as it was safe and obviated the presence of poles on the sidewalk. To obtain this permission, the company paid to house owners the amount of the cost price of the poles—47 marks ($11.20) for a one-wire anchor, and 63 marks ($15) for a two-wire anchor. Wherever the poles are set up they are of very neat appearance, and serve not only for the electric street-car wires, but also as electric light poles.

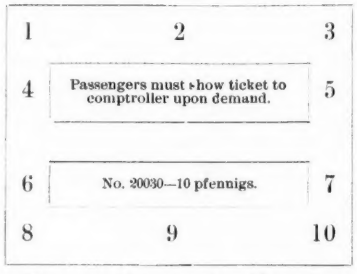
In some instances, the streets proved to be too narrow to lay a double track, and, in order not to diminish the strength of the current, a double-trolley wire was strung.

Some 10 years ago, before the system was planned, the state of Hamburg had granted a monopoly of electrical appliances and currents on the public roads to the Hamburg Electricity Works. When the shareholders of the present electric street car company resolved to build the road, and also to build their own electrical plant, the Hamburg Electricity Works insisted upon its rights as the only body entitled to build electrical appliances and currents on the public roads of the city of Hamburg. A satisfactory arrangement was made, finally, between the street car company and the electricity works, the latter enlarging its plant in order to supply to the street-car company the electricity required to move 500 trolley cars (or large cars) and 400 trailers (or small cars) called "smoking cars." These smoking cars are simply the old horse cars and are coupled to the trolley car by means of a link or connecting rod. About every third trolley car has one of these trailers.

The Hamburg Electricity Works pays to the state of Hamburg 20 per cent of its gross income as a return for the monopoly; the street-car company pays for the electric current 12½ pfennigs (2.97½ cents) per kilowatt-hour. The state of Hamburg refunds to the Electric Street Car Company 20 per cent of this price, leaving a net cost price for the electric current of 2.38 cents per kilowatt-hour.

As a compensation for the use of the public roads, the street-car company pays to the state 1 pfennig (0.238 cent) for each passenger. The average fare for each person carried being 11 5 pfennigs (2.74 cents), the state receives 8.7 per cent of the gross income of the company. In addition to this, the street-car company must keep the paving inside of the tracks, and 30 centimetres (11.8 inches) outside of each track, in proper condition.

The fares on the Hamburg trolley cars are exceedingly low. After long experimenting, the "tariff of distances" was found to be the better plan, and was approved by the senate. It might be mentioned here that the street-car company is not at liberty to fix the price of the fare on its lines, but must forward passengers at the rate fixed by the board of public traffic, to be approved by the senate. All lines are divided into zones of 2,000 meters (1.24 miles), and the fare is as follows: For the first two zones, 10 pfennigs (2.38 cents); for each two zones or part thereof, thereafter, 5 pfennigs (1.19 cents). Each passenger, upon payment of the fare, receives from the conductor a ticket, which is cut off from a long roll of tickets, each ticket being provided with a number. The tickets have different colors—yellow for the 10 pfennig, or two-zone distance; green for the 15 pfennig, or four-zone distance; blue for the 20 pfennig, or six-zone distance, etc. The following is a diagram of a ticket, showing the controlling number and other controlling marks, hereafter described:



The numbers on the sides of the tickets indicate the zones; the conductor must tear out that zone number at which the passengers step on the car. In this way, it is impossible for passengers to commit fraud by buying a two-zone ticket for a four-zone trip, etc., as it can at once be seen where they stepped on the car, and an attempt to deceive can be detected. When the conductor collects the fare, it is his duty to inquire the destination of the passenger, so that he knows exactly whether a 10, a 15, or a 20-pfennig ticket should be given. At the end of each two zones, the conductor fills in a blank form, and states the last number of each grade of ticket sold. If a comptroller steps on the car (and he is liable to step on at any time), he simply counts the number of passengers, which must also be the total number of tickets sold; if there is a discrepancy, it proves that either there is a passenger on the car who has not paid, or that the conductor has collected the money but neglected to give out a ticket. The passengers are then requested to show their tickets; the passenger having no ticket, whether he says he has paid his fare or not, must pay again, and the conductor is fined 1 mark (24 cents) for the first offense, 3 marks (72 cents) for the second, and discharged at once when the third offense is detected.

The commutation ticket system is a peculiar feature. The street-car company, acknowledging the fact that hundreds of people are bound to use the cars a dozen or more times a day, has issued "commutation tickets," divided in two sections. The first section entitles the holder of a commutation ticket to the use of one line in both directions, and as many times as he chooses, including Sundays. The second section issues commutation tickets for the use of all lines, in all directions, and allows the holder to avail himself of the accommodations as many times as he chooses. These tickets are valid from three to twelve months, and the prices are so low that, if a person uses the cars over three times a day, a commutation means a saving, in some cases the fare for each trip amounting to less than 1 cent.

Prices for commutation tickets are as follows:

Duration of Ticket.	One Line.	All Lines.
3 months	$5 95	$11.07
4 months	7.62	14 28
5 months	9 28	17.37
6 months	10.95	20.47
7 months	12.38	23.12
8 months	13 80	25.94
9 months	15.23	28.56
10 months	16 54	30 94
11 months	17.85	33.32
12 months	19 04	35.70

In addition to this, combination tickets may be had for the use of one specified line and part of one other line, and, also in this instance, prices are extremely low. Further, very cheap tickets are issued for children going to school. These tickets are personal, a trip costing about four pfennigs (0.95 cent).

The cars stop only at fixed halting places to take on and let off passengers, these halting places are generally at street crossings, marked by a white sign affixed to a pole.

The trolley cars offer seats for 20 to 28 persons, 10 to 14 on each side. Besides, four persons are allowed on the front and five persons on the back platform. The full number of passengers being on the car, the conductor lowers a sign, "Besetzt," which means "occupied," and a car can not take more passengers than the above number. The regulations in this respect are very strictly observed. Say, for instance, a lady steps on the car at a halting place, while the conductor is front, collecting fares, the car being already "occupied" when the lady stepped in; but there being no conductor to prevent, she goes inside and a gentleman offers her his seat, the gentleman then taking a stand on the platform. The conductor returns to his post, when the gentleman is requested to step off the car at the next halting place, having forfeited his seat and the car being fully occupied. Should he refuse to leave the car, he is put off. The policemen on the streets have instructions to watch the cars sharply when passing their post, and if they detect a car carrying one person more than the fixed number, the policemen note the number of the car, and the company receives word that the said conductor has been fined 72 cents, to be deducted from his wages and to be paid to the police board. If a comptroller of the company steps on the car and detects a surplus of passen-

gers, he notes the number of the conductor, who is fined 72 cents, which is paid to a charity fund and divided once a year to employés of the company requiring support.

All cars—not only the trolley cars, but also the smokers—are supplied with hand and electro-magnetic brakes; the latter are applied in case of danger, and afford a sudden halting of the car. There are no fenders in use on the cars, but accidents are few. Experiments are being daily made with all sorts of safety appliances to test their reliability, but up to the present the company has not decided to introduce any particular system on all cars. There is certainly an opportunity here for a good American device, as the different appliances now in use are not fully satisfactory to the company or to the authorities.

The Hamburg Electric Street-Car Company must be considered a model institution, and its system worthy of careful study.

The Bell Telephone Company, of Philadelphia, has listed $873,150 additional stock.

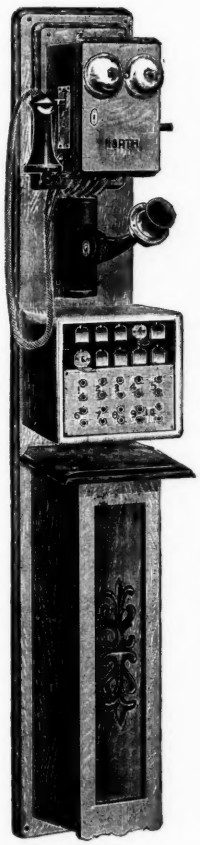


FIG. 1.—A FARMERS' COMMUNITY TELEPHONE SET.

Farmers' Community Telephone Exchanges.

When the telephone was invented few people thought that the time would ever come when this necessity of modern civilization would be put within the reach of the farmers. Such, however, is now the case, the independent telephone companies having accomplished this desirable end. They formerly put the benefit of this convenience within the reach of the great middle class in the city; now they have gone one better and are commencing to furnish service to the farmers. Telephony can never reach its place in civilization until the farmer is able to come into immediate verbal intercourse with his neighbor, physician, butcher and grocer. Not only has this been done, but where this service is furnished to farmers some exchanges are even giving their patrons the latest market reports, thus enabling them to tell when to sell their products to the best advantage. So, also, can the commission man in the city come into direct relations with those who furnish him with his products.

The North Electric Company, of Cleveland, Ohio, has recently brought out what it calls a "farmers' community exchange," by the use of which the city exchange is enabled to furnish a service to the farmers in its neighborhood at a price that is profitable to the exchange and, at the same time, within the reach of patrons in the country.

In the accompanying chart is shown a method which the North company advocates, in placing community exchanges in the territory surrounding a city. At various points are located one of the switchboards illustrated herewith. From this central point radiate 8 or 10 lines, to each of which are connected several subscribers, preferably not over 10. This community exchange is connected by a trunk line to the city exchange, as are also the trunk lines from the several other community exchanges. Patrons are enabled to converse with any of the other subscribers to their own exchange, or, by trunking into the city exchange and from there to any of the other community exchanges, are enabled to reach any of the patrons of the city or other community exchanges. The subscriber can likewise connect to any of the toll lines that may run into the city exchange.

Each farmer's telephone is of the long-distance type, and he is enabled to talk to any point that the toll service reaches. The switchboard used at the community exchange is very simple and efficient and, it is stated, practically impossible to get out of order.

Quite a number of telephone exchanges have adopted this service with profit, and are now paying dividends where they formerly cleared but little money.

It will be noticed in the chart that the lines from the community exchange to the subscribers' stations are shown in connection with only one community exchange. If the reader will imagine the lines radiating from the other community exchanges shown, he will see that the territory is completely covered, and the patronage of the average exchange would often be more than doubled.

The day should speedily come when every city exchange can give service to the farmers in its vicinity, and when this time comes telephony will have a scope never before dreamed of by the majority.

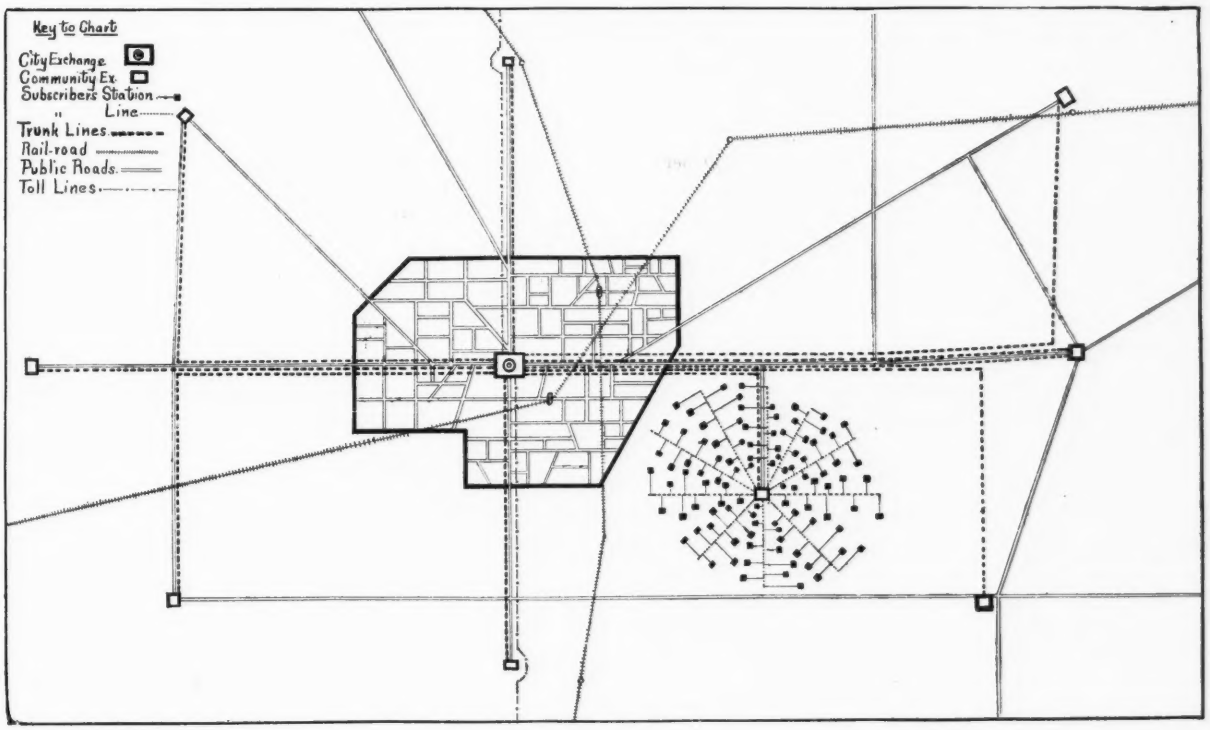


FIG. 2.—CHART SHOWING METHOD OF LOCATING FARMERS' COMMUNITY TELEPHONE EXCHANGES.

BUSINESS NEWS.

The Woods Motor Vehicle Company, of Chicago, is sending out a handsomely illustrated catalogue descriptive of its extensive line of electromobiles.

The St. Louis office of the General Incandescent Arc Light Company, of New York city, has been moved from the Security Building to 638 Century Building. It will hereafter be known as a sales office of the "G-I" company instead of a branch of the Martin J. Insull Company, as heretofore.

ADVANCE INFORMATION

New Incorporations.

CLEVELAND, OHIO—The Electric Controller and Supply Company has been incorporated, with a capital stock of $30,000.

CHICAGO, ILL.—W. R. Garton & Company has been incorporated; capital, $10,000; contracting engineers in electrical and mechanical construction; incorporators, W. R. Garton, Ray P. Lee, I. A. Lee.

YOUNGSTOWN, OHIO—The Colonial Electric Company has been incorporated; capital stock, $100,000.

SAN FRANCISCO, CAL.—The National Telephone Device Company has been incorporated to manufacture and sell inventions of all kinds; capital, $100,000; incorporators, J. Kahn, C. K. Rosenberg, A. M. Brown, M. Schlesinger, N. A. Judd, all of San Francisco.

CHICAGO, ILL.—The Western Carbon Company, with a capital stock of $3,000, to manufacture and deal in electrical supplies and appliances, has been incorporated; incorporators, J. F. Sanders, Colin C. H. Fiffe, Roswell B. Mason.

New Telephone Companies.

CHICAGO, ILL.—The Union Electric Telephone and Telegraph Company has been incorporated, with a capital stock of $2,500; incorporators, Frank L. Bills, E. L. Wortham and H. L. Wortham.

ROCHESTER, N. Y.—The recently incorporated Syracuse, Rochester & Lake Ontario Telephone Company will, it is stated, operate a system extending along the Lake Ontario shore from Rochester to Oswego; through the territory of the Central-Hudson and West Shore railroads between Rochester and Syracuse, and also on the Auburn division of the Central-Hudson, taking every village from Rochester to Oswego and Syracuse. It is said that the new company will run in opposition to the Bell company. All the local exchanges in the localities named will be taken in, and it is expected that the new service will be one-half of that now existing. The new line will probably give a long-distance connection to the Ontario Telephone Company, at Oswego. It will not absorb the Ontario system, however.

AUBURN, IND.—The National Telephone Company, which operates in this city and has a line to Fort Wayne, will extend its line from here to Butler, where the line will be connected with those of the Butler and the United States Telephone companies. This will give the Butler Telephone Company connections as far east as Cleveland, and also into Southern Michigan and to Fort Wayne and near-by towns.

CLAYTON, IND.—The Clayton Mutual Telephone Company has been incorporated; capital, $10,000; incorporators, J. C. Winstead, A. R. Morley, E. B. Owen, H. Brown, R. S. Woodson, C. C. Walls, W. E. Hubbard, all of this place.

DARLINGTON, IND.—The Darlington Telephone Company has been incorporated to operate a telephone exchange; capital, $10,000; incorporators, D. Lewis, N. E. Craig, T. M. Campbell, J. A. Peterson, J. Paterson, R. C. Dunnington, L. W. Little, all of Darlington.

JUNEAU, ALASKA—A subsidy has been raised here for the construction of a telegraph line to Skagway, there to connect with the line to Dawson. It is hoped to have the line in operation by October 1.

CHIPPEWA FALLS, WIS.—An effort is being made to organize a new telephone company in this city.

MARIETTA, OHIO—A telephone franchise has been granted to the National Telephone Company, of Columbus. The ordinance gives free service to all parts of Washington County, and rates $12 per year less than the Bell Telephone Company, the only one now operating. The work to begin in 60 days.

FINDLAY, OHIO—Ex-Postmaster Briggs and Judge W. J. Wagner, of Tiffin, are organizing a company here to put in a second telephone plant, to be connected with the United States long-distance system. They expect to have 1,000 subscribers here.

DANVILLE, KY.—The Citizens' Telephone Company, of Boyle County, has been incorporated, with the following as the leading stockholders: B. T. Wood, J. E. Caldwell, T. C. Prewitt, J. A. Carpenter, George W. Edwards, Henry Gray, J. H. Robinson and W. J. Debaun, of Boyle County; Jordan Stewart, Woodson Hatchett and James Bottom, of Washington County.

BURLINGTON, IOWA—The Mutual Telephone Company has been incorporated. It has a capital stock of $2,500. Robert Moir, Jr., Robert Hodson, Walter Stutts, R. T. Robinson, James Moir and Alex Moir, incorporators.

MOUNT VERNON, IOWA—The Mount Vernon Telephone Company, Linn County, has been incorporated with the Secretary of State. It has $10,000 authorized capital, of which $3,000 is to be paid in full by September 1, when business will be commenced. The incorporators are C. W. Kepler, E. B. Wilcox, James E. Harlan, Wm. E. Platner, J. B. Albrook, J. B. Robinson, T. A. Gormly, W. A. Smith and A. C. Tenney.

HAMMONTON, PA.—The Atlantic County Telephone Company has had an ordinance introduced into councils to secure a franchise for a local telephone system.

WILMINGTON, DEL.—The Clinton Telephone Co. has been incorporated; capital, $50,000; incorporators, G. W. Kimball, Charles W. Smith, James L. O'Neill, all of Wilmington.

Electric Light and Power.

BLOOMSBURG, PA.—A deal has just been completed whereby the stock of the Bloomsburg Electric Light Company, which was controlled by the General Electric Company, has been sold to the American Electric Light Company, of Bloomsburg. The new enterprise has a capital stock of $90,000, and the incorporators are P. R. B. Evans, Carbondale; George Reynolds, Wilkesbarre; W. D. Boyer, Scranton; J. B. Russell, Wilkesbarre, and Grant Pelton, Scranton.

ORANGETOWN, N. Y.—The Rockland Light and Power Company has been incorporated; capital, $75,000; incorporators, W. C. Bradley, G. L. Chapman, of South Nyack; R. P. Barry, Jr., L. S. Homer, of New York city; G. E. Spencer, of Brooklyn.

ELWOOD, IND.—The Elwood Electric Light Company to construct and operate electric light plant has been incorporated; capital, $80,000; incorporators, C. I. Tuyson, C. N. Horitz, W. A. Horitz, N. C. Hook, H. G. Harting, H. C. Galloway, E. C. Horitz, all of Elwood.

WARREN, OHIO—Warren and Youngstown men will organize a company with $100,000 capital to engage in the electric light business. The company will absorb the Orient Electric Works at Youngstown. Those interested are T. H. Gillmer, E. W. Gillmer, E. E. Nash, E. E. Roberts, and Mayor C. Ward, of Warren; G. M. McKelvey, Wick Gans and Mason Evans, of Youngstown.

MOUNT KISCO, N. Y.—The new power-house for the Mount Kisco Electric Lighting Company is almost completed, and the company will begin lighting the village September 1.

PIERRE, S. D.—The Empire State Light Company has been incorporated, with a capital stock of $100,000.

PIERRE, S. D.—The Rockland County Chemical Battery, Light, Heat and Power Company has been incorporated, with a capital of $100,000. Incorporators, William A. Tubbs, William Eberles and G. V. Pattison.

COLDWATER, MICH.—By a vote of 132 to 54, Bronson citizens voted to bond the village for $8,000 to establish an electric light plant.

New Electric Railways.

POTTSVILLE, PA.—The several companies operating the electric roads through and centering in Pottsville have all been consolidated into one company, known as the Pottsville Union Traction Company. The lines now operated by the Schuylkill Electric Railway, the Pottsville & St. Clair, the Pottsville & Tamaqua, the Mount Laffee, the Pottsville & Reading, and Schuylkill Haven & Orwisburg companies are all embraced in the new deal. One set of directors will control the business in the future.

PORTLAND, ME.—The Metropolitan Electric Third Rail and Traction Company, with a capital stock of $500,000, has been incorporated.

FORT WORTH, TEX.—The St. Louis, Oklahoma & Southern Railway Company has been chartered to build a line from an intersection with the Frisco to a point on Red River, near the Grayson County line, a distance of 200 miles.

Manufacturing Notes.

The Bullock Electric Manufacturing Company, of Cincinnati, has just completed the shipment of an electric printing press equipment for the *Daily Mail*, of London. This makes the twelfth shipment this year of electric presses for English newspapers.

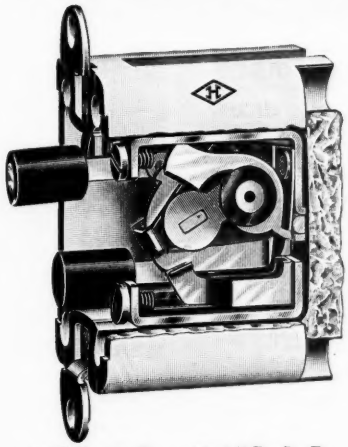
The World's Dispensary Medical Association, of Buffalo, are making important changes in their power and machinery equipment. A large Hoe press of special construction is being installed, and the power transmission for the whole establishment is being changed to electrical transmission, the American Engine Company, of Bound Brook, furnishing the engine, generator and motors. The generating plant consists of an American-Ball duplex compound engine and direct-connected generator, and the motors comprise both belted and direct-connected types. The lighting of the premises is also done from the same circuit.

A statement has been received from Fred M. Locke, Victor, N. Y., maker of the "Locke" types of insulators, to the effect that the examiner in the Patent Office decides "an insulator nested together and fused together with glaze to be the invention of Mr. Locke." The statement contains the following: "Mr. Locke filed his application for letters patent in February, 1897, and, in August of the same year, Mr. Boch, of the R. Thomas & Sons Company, of East Liverpool, Ohio, filed an application for the same thing. An interference was declared between the two applications, and also between Mr. Locke and a patent granted March 8, 1898, to Mr. Boch, which comprises substantially the same invention, except that the parts were fused together with extra glaze. Interference proceedings have been pending since September, 1897, and about three weeks ago the Patent Office decided that Mr. Locke had proved 'that Locke was the first to conceive, disclose and reduce to practice the invention in issue; judgment of priority is awarded to Fred M. Locke.' And, in the second interference with the patent of Mr. Boch, the examiner held that 'whichever party is entitled to prevail as to the issue in one interference is equally entitled to prevail in the other; the fact in this instance, the burden of the proof is upon Locke and that Boch is the patentee is of no moment, for, to the examiner's mind, Locke has established his claims of priority beyond a reasonable doubt; judgment of priority of invention is awarded to Fred M. Locke.'"

Judgment Against the Safety Third-Rail Electric Company.

A judgment for $1,208 89 has been filed against the Safety Third-Rail Electric Company, of New York city, by the *Electrical World and Engineer*.

"Diamond H" Push Switches



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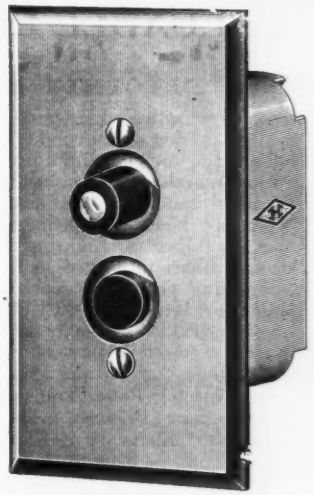

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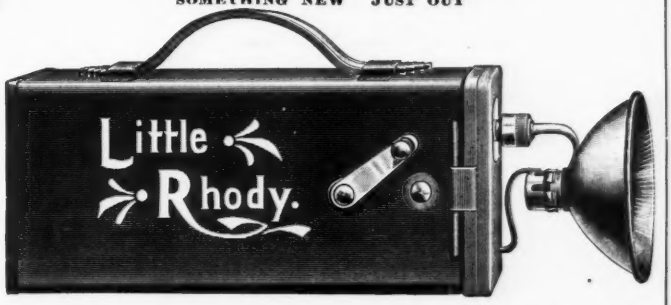

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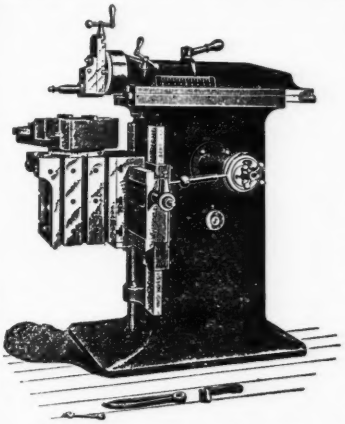

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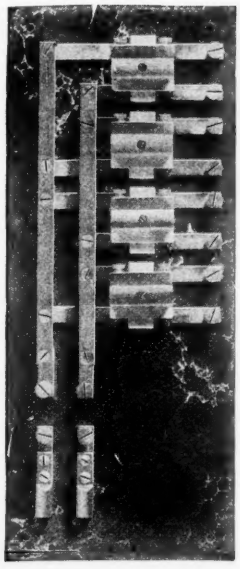

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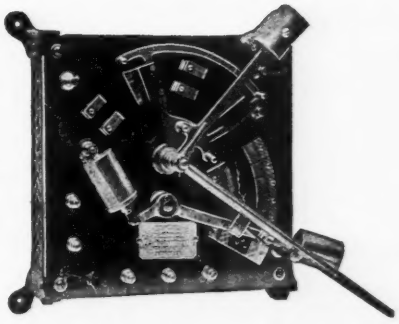

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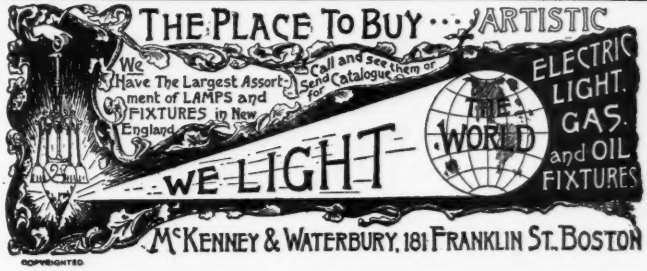
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Commutator Bars and Repairing.
Forest City Electric Works.

Commutator Lubricant.
Allen & Co., L. B.
Mona Manufacturing Co.
Ohio Electric Specialty Mfg. Co.

Condensers (Electric)
Marshall, Wm.

Conduits.
American Vitrified Conduit Co.
Camp Co., H. B.
Michigan Pipe Co.
National Conduit & Cable Co
Wyckoff Creosoting Co.

Connectors and Terminals.
McIntire Co., The C.

Cord Electric.
Samson Cordage Works.

Contractors.
Webster, Geo. G.

Dynamos and Motors.
Bullock Electric Mfg. Co.
Central Electric Co.
General Electric Co.
General Incandescent Arc Light Co.
Siemens & Halske Electric Co.
Warren Electric Manufacturing Co.
Westinghouse Electric & Mfg. Co.

Electric Locomotives.
General Electric Co.

Electric Novelties.
Ohio Electric Works.

Electric Heaters.
American Electrical Heater Co.

Electrical Instruments.
Bossert Electric Construction Co.
Central Electric Co.
General Electric Co.
General Incandescent Arc Light Co.
Keystone Electrical Instrument Co.
Whitney Electrical Instrument Co.

Electric Soldering Irons.
American Electrical Heater Co.

Electric Launches.
Sterling & Co., C. B.

Electrical Supplies.
Bibber-White Co.
Bunnell & Co., J. H.
Central Electric Co.
Electric Appliance Co.
Jones, J., & Son.
Novelty Electric Co.
Ohio Electric Works.
Stewart, Frank H., & Co.
Western Electric Co.

Electromobiles.
American Electric Vehicle Co.

Engineers and Contractors.
McCay Engineering Co.
New England Engineering Co.
White & Co., J. G.

Engines.
American Engine Co
Ball & Wood Co.

Fans and Fan Motors.
Central Electric Co.
Diehl Mfg. Co.
Emerson Electric Mfg. Co.
General Electric Co.
General Incandescent Arc Light Co.
Paragon Fan & Motor Co.
Warren Electric & Specialty Co.

Fiber.
Kartavert Mfg. Co.

Fixtures, Gas and Electric.
McKenney & Waterbury.

Fuse Wire and Links.
General Electric Co.
McIntire Co., The C.

Globes, Shades, Etc.
Frink, I. P.
Phœnix Glass Co.

Graphite.
Dixon Crucible Co., Jos

House Goods.
Central Electric Co.
Ostrander & Co., W. R.

Instruments (Testing and Recording.)
Bristol Co., The
General Electric Co.
General Incandescent Arc Light Co.
Knott Apparatus Co., E.
Machado & Roller.
Keystone Electrical Instrument Co.
Westinghouse Electric & Mfg. Co.
Whitney Electrical Instrument Co.

Insulators and Insulating Material.
Central Electric Co.
Empire China Works.
Kartavert Mfg. Co.
Standard Paint Co.
Standard Underground Cable Co.
Sterling Supply & Mfg. Co.

Junction Boxes.
Bossert Electric Construction Co.
General Incandescent Arc Light Co.
Ward Leonard Electric Co.

Lamps, Arc.
Central Electric Co.
Diehl Mfg. Co.
General Electric Co.
General Incandescent Arc Light Co.
Standard Thermometer & Electric Co.
Western Electric Co.
Westinghouse Electric & Mfg. Co.

Lamps, Decorative.
Central Electric Co.
General Incandescent Arc Light Co.

Lamps, Incandescent.
American Endoscopic Co.
Buckeye Electric Co.
General Electric Co.
General Incandescent Arc Light Co.
Hardy Lamp Works.
New York & Ohio Co
Ohio Electric Works.
Sawyer-Man Electric Co.
Shelby Electric Co.
Sperry, B. N.
Westinghouse Electric & Mfg. Co.

Lightning Arresters.
General Electric Co.
McIntosh, Jas D.
Westinghouse Electric & Mfg. Co.

Machine Tools.
Garvin Machine Co.

Mast-Arms.
Brady, T. H
Meserve, F. W.

Meters.
Fort Wayne Electric Works.
Siemens & Halske Electric Co.

Mica.
Munsell, Eugene.

Paint.
Standard Paint Co.

Patent Solicitors.
Duvall, Edw. S.
Thornberry, Henry S.

Platinum.
Baker & Co.

Poles, Brackets, Pins, Etc.
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Central Mfg. Co.

Porcelain Manufacturers.
Empire China Works.

Rail Bonds.
Forest City Electric Co.
Morris Electric Co.
Roebling's Sons Co., John A.

Railway Specialties (Electric).
Central Electric Co.
Electric Appliance Company.
General Electric Co.
Novelty Electric Co.
Sterling Supply and Mfg. Co.
Western Electric Co.
Westinghouse Elec. and Mfg. Co.

Reflectors.
Frink, I. P.
Pairpoint Mfg. Co.
Wheeler Reflector Co.

Rheostats.
Cutler-Hammer Mfg. Co.
General Incandescent Arc Light Co.
Ohio Electric Specialty Mfg. Co.
Ward Leonard Electric Co.

Schools.
American School of Correspondence.
Electrical Engineer Institute of Correspondence Instruction.
International Corresp. Schools
United Correspondence Schools.

Soldering Sticks.
Allen & Co., L. B.

Specialties.
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General Incandescent Arc Light Co.
Ohio Electric Works.

Steel Spring Wire.
Boker & Co., Hermann.
Cary Spring Works
Manross, F. A.

Storage Batteries.
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Electric Storage Battery Co

Switchboards.
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General Electric Co.
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Large & Co.
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General Electric Co.
General Incandescent Arc Light Co.
Hart & Hegeman Mfg. Co.
Hart Mfg. Co.
Jones & Son, J.
Paiste Co., H. T.

Telephones.
American Bell Telephone Co.
American Elec. Telephone Co.
Bunnell & Co., J. H.
Central Electric Co.
Central Telephone & Electric Co.
Connecticut Telephone & Electric Co.
Couch & Seeley Co.
Eureka Electric Co.
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Mianus Electric Co.
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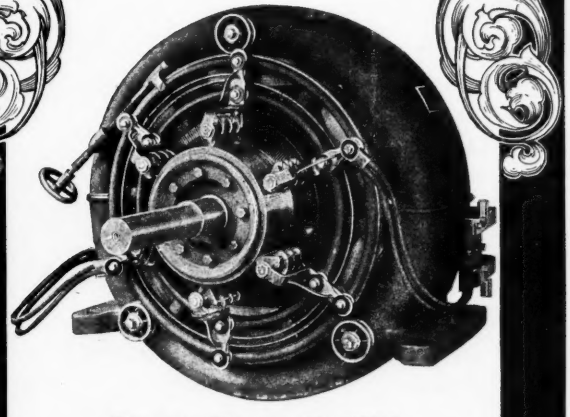

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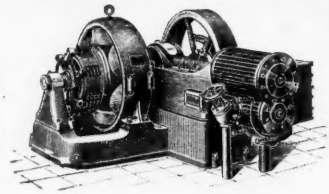

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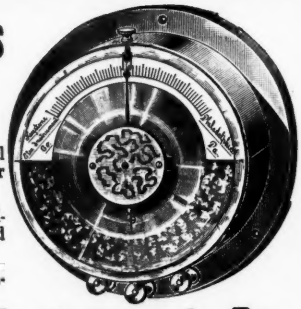

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